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SECOND SERIES: PULMONATA

MANUAL
OF
CONCHOLOGY

VOL. XXVII

PUPILLIDÆ

(ORCULINÆ, PAGODULINÆ, ACANTHINULINÆ, ETC).

BY

HENRY A. PILSBRY, Sc.D.

ABIDAS AND CHONDRINAS OF THE PYRENEES AND THE IBERIAN PENINSULA, BY DR. F. HAAS

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PREFACE

Descriptive matter relating to Pupillidæ is completed in the present volume. A summary of the anatomical structure and notes on the distribution will form part of the volume to follow.

In addition to many friends in Europe, America, Australia and Asia who gave material and information acknowledged in former volumes, I would here thank those who have contributed to this one. Dr. F. Haas of the Senckenberg Museum has given an admirable exposition of the Pyrenean Abidas and Chondrinas which makes amends for the inadequate treatment of these groups in volumes XXIV and XXV. Mr. P. Hesse of Venice generously lent unfigured types of various Orculæ and Agardhiæ from his collection. Dr. A. Wenz contributed catalogues of the Tertiary species of various European genera. Mr. J. R. Le Brocton Tomlin, Dr. V. Sterki, Dr. Bryant Walker and Professor T. D. A. Cockerell lent types and other specimens from their collections. Finally, my old friend and collaborator Dr. C. Montague Cooke, joined with me in supplemental work on Hawaiian species.

I wish also to express my appreciation of the work of Mr. E. G. Vanatta on the Index, and of Miss Helen Winchester, who drew the illustrations for this and the preceding volumes.

Figures copied from other publications have been reproduced from the originals photographically, the sources being duly acknowledged in the Explanation of Plates.

H. A. P.

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MANUAL OF CONCHOLOGY

Subfamily ORCULINÆ.

Genus ORCULA Held.

Orcula HELD, Isis, 1837, p. 919.—GRAY, P. Z. S., 1847, p. 176, and HERRMANNSEN, Indicis, ii, p. 158, type *P. dolium.*

Sphyradium "Agassiz", CHARPENTIER, Cat. Moll. Suisse, in Nouv. Mém. Soc. Helvet. Sci. Nat., i, 1837, p. 15.—MARTENS, Die Heliceen, 1860, p. 295, type *Pupa doliolum.*

Pupula "Leach" MOERCH, Catal. Yoldi, 1852, p. 34. *Pupa dolium* here selected as type. Not of Charpentier, 1837.

Scyphus "Monterosato", CAZIOT and MARGIER, Bull. Soc. Zool. France, 1909, p. 141. *Orcula doliolum* here selected as type.

Pilorcula GERMAIN, Bull. Mus. Nat. d'Hist. Nat., 1912, p. 448, for *Pupa raymondi;* Voy. Kerville: Moll. terr. et fluv. Syrie, 1921, p. 328.

The shell is cylindric or cylindric-conic, rimate and sometimes perforate, compact, the first whorl smooth, second generally microscopically striate spirally; following whorls slowing increasing, striate or with epidermal riblets. Peristome varying from barely expanded to reflected, generally thickened within. The *parietal lamella enters deeply;* angular lamella small and tubercular or wanting. *Columellar and supra-columellar lamellæ developed,* at least inside, and either emerging to the peristome or immersed; sometimes other short lamellæ on the columella, and in some species there is a lower-palatal fold, visible in the aperture or deeply immersed, subventral. The parietal and columellar lamellæ arise at the beginning of the neanic stage and are absorbed behind as growth proceeds, finally remaining in the last one or two whorls only.

Type: *O. dolium* (Brug.). Distribution: France to Transcaucasia and northern Persia; Tunis and Abyssinia. Fossil in Eocene of Europe to the Pliocene of Algeria and Italy.

Though the number of species is small, about 15, over 80 names have been applied to forms of one kind or another, hence the length of this monograph. A large proportion of the varietal names are not valid, being homonyms; but since the taxonomic values are uncertain, the correction of nomenclature is left to European conchologists.

The description of *Orcula tingitana* Pallary, Bull. Hist. Nat. Afric. Nord, 1818, p. 149, is not accessible to me.

Reinhardt (Jahrb. d. m. Ges., 1877, p. 280) has described the lamellæ of the early stages of *O. doliolum*. A résumé of his description follows.

The embryonic shell of *O. doliolum* (pl. 5, fig. 1) has 1½ whorls and is smooth, but under high magnification it shows close spiral striation on the upper side, which ceases abruptly with the embryonic whorls, to give place to transverse ribs. The lower side is smooth. Whether lamellæ are present at this stage was not ascertained, but none was seen through the shell. In the following ribbed stage the ribs run out into spines at the keel, as in *A. aculeata*, giving the young an extremely beautiful appearance; they continue on the base and gradually disappear towards the umbilicus. There is a sharp thread median on the parietal wall, running far in and showing through the shell. It usually appears as if interrupted, with thickened white points, "knot-points", on the angles (pl. 5, fig. 2). In one with 2 whorls, only the last half-whorl ribbed, there are 2 knot-points. With the 3-whorled stage a new thread, the columellar lamella, appears. There are therefore two threads, a parietal with 3 knot-points, and a sharp, horizontal lamellar without knots (pl. 5, fig. 3). With further growth the columellar lamella grows higher. The supracolumellar appears weakly at the 4½-whorl stage, and becomes distinct at 5 whorls. As the shell grows into the Pupa form, the knots disappear. In the adult shell all of the lamellæ of the earlier whorls have disappeared.

The presence of a lower-palatal fold, so far immersed that it is subventral in position, was noticed by Reinhardt (1880) but by no other author. Westerlund, indeed, doubted its reality, thinking that what Reinhardt saw was the parietal lamella shining through (Fauna, iii, 87). From the occurrence of this fold in at least two unrelated stocks, *O. gularis* and various forms included in or related to *O. scyphus*, it would appear to be an ancestral structure now disappearing.

The species are often not strongly differentiated, but some characters of value are to be found in the details of structure of the lamellæ within the last whorl. Unfortunately, nothing of this has been noticed by previous authors.

Tertiary Species.

Dr. W. Wenz of Frankfurt has contributed a catalogue of Tertiary Orculæ.

Orcula oviformis (Michaud). *Pupa oviformis* Michaud, Actes Soc. Linn. Bordeaux, x, 1838, p. 157, pl., fig. 5*a*, *b*.—*Vertigo oviformis* Cossmann, Cat. ill. coq. foss. env. Paris, iv, 1889, p. 361. Palæocene, Thanétien: Rilly near Reims; Sparnacien: Bernon near Epernay.

Orcula plateaui (Cossmann). *Pupa (Orcula) plateaui* Cossmann, Cat. ill. coq. foss. env. Paris, iv, in Ann. Soc. Roy. Malac. Belgique, XXIV, 1889, p. 360, pl. 11, fig. 34. Lower Palæocene, Thanetien: Chenay (Dép. Marne).

Orcula subconica (Sandberger). Pl. 4, fig. 10. *Pupa (Pupilla) subconica* Sandberger, Die Conchylien d. Mainzer Tertiärbeckens, 1858, p. 51, pl. 5, fig. 7, pl. 35, fig. 11.—Slavik, Archiv d. naturwiss. Landesdurchforsch. von Böhmen, 1869, i, 2, p. 272.—*Pupa (Orcula) subconica* Sandberger, Die Land- u. Süsswasser-Conchylien d. Vorwelt, 1874, pp. 394, 438, pl. 23, figs. 8-8*b*. — *Orcula subconica* Boettger, Jahrb. Nassau. Ver. f. Naturk. Wiesbaden, xlii, 1889, pp. 238, 241, 319. Upper Oligocene, Chattien: Landschneckenkalk, Hochheim. Lower Miocene, Burdigalien: Landschneckenkalk, Tuchorschitz, Bohemia. *Pupa dolium antiquum* A. Braun, Verh. Naturf. Vers. Mainz, 1842, p, 149, no description, is said to be this species.

This early *Orcula* is, as Sandberger observed, similar in form to the recent *O. conica* (Rm.). Subequal columellar and supracolumellar lamellæ emerge to the peristome, and within the back are strong and subequal. Below them is an infracolumellar which does not penetrate. The parietal lamella is a whorl long, and the angular tubercle is well developed. The shell is apparently of quite as modern type as some of the recent Alpic species. The specimen figured is from the Landschneckenkalk of Hochheim-Flörsheim.

ORCULA AMBLYA (Bourg.). *Pupa amblya* Bourguignat, Paléont. Moll. Algerie, 1862, p. 75, pl. 4, f. 11-13. Pliocene? Oued Tademit, 15 leagues southwest of Djelfa, Algeria. A species probably near *O. doliolum*, 9-12 mm. long. 2-2.7 wide, of 10-12 whorls. The parietal lamella is rather small; no columellar folds mentioned or figured, therefore evidently deeply immersed.

O. DOLIUM var. PLIOPEDEMONTANA Sacco, I Moll. terreni Terziarii del Piemonte, pt. 22, 1897, p. 69, from the Upper Pliocene, Astien, at Fossano, is insufficiently described as having more distinct ribs, the columellar teeth quite high, produced towards the aperture. No figure; the reference to ribs is ambiguous in this species.

The Recent European species of *Orcula* are mostly well known, and readily distinguishable by external characters, but much remains to be done in systematizing the subspecific forms and determining which have racial value. Some of the Asiatic species, such as *scyphus* and *sirianocoriensis*, appear to be more or less heterogeneous aggregates impossible to systematize until a comparative study of the internal structure can be made.

The species are so connected that no well-defined subgenera can be based on shell-characters. Three sections may be distinguished thus:

Outer lip reflected: Section *Sphyradium* 'Ag.' Charp. (included in paragraphs 7, 8, 10-12 of the key following).
Outer lip merely expanded more or less, generally thickened within.
  Having a series of bristles at the upper third of each whorl (frequently wanting); internal lamellæ extremely broad: Section *Pilorcula* Germain.
  Without such bristles: Section *Orcula* proper.

European Species (exclusive of Caucasus region).

1 Lip more or less expanded, not reflected; shell rimate and perforate (2)
Lip reflected; shell rimate, imperforate (7)

2 A white palatal callus a short distance *within* the outer lip, with or without an entering lower-palatal fold. *O. gularis,* no. 2
Inner margin of lip calloused or not; no palatal fold (3)

3 Parietal and columellar lamellæ very much enlarged within the last whorl, and emerging to edge of peristome (4)
Parietal and columellar lamellæ only moderately or not enlarged within last whorl (5)

4 Shell having irregularly-spaced epidermal riblets; about 6.5 x 3.5 mm. *O. jetschini,* no. 5
Finely striate; 5 to 6 x 2.8 mm. *O. conica,* no. 3

5 With fine, sharp, largely epidermal striæ; thin, ovate; aperture indistinctly triangular. *O. schmidti,* no. 4
Striate, without epidermal threads; aperture truncate-oval, broadly rounded basally (6)

6 Parietal and columellar lamellæ penetrating inward to or beyond the ventral side. *O. dolium* and varieties, no. 1
Lamellæ much shorter; loess of Germany and Austria. *O. d. plagiostoma,* no. 1*e*

7 Parietal lamella low and short, no columellar lamellæ visible; 6.5 x 3 mm., 9-10 whorls. *O. bulgarica,* no. 8
Parietal lamella entering deeply (8)

8 Having spaced epidermal riblets when well preserved; parietal lamella not much enlarged within. *O. doliolum,* no. 6
Finely striatulate; parietal lamella high and flaring outward within; Greece. *O. s. græcus,* no. 12*e*

Species of Asia and Africa.

9 Peristome reflected (10)
Peristome from slightly to well expanded, more or less thickened within (13)

10 Perforate, compressed around the base; aperture angular below, parietal callus very strong; 10 x 4 mm. *O. robusta*, no. 11
Imperforate; not angular basally; smaller (11)

11 Having spaced epidermal riblets when well preserved; no palatal fold within; 4.5 to 6.5 mm. long (12)
Finely striate without spaced riblets; lip strongly calloused within; a very deeply immersed palatal fold. *O. s. batumensis* and allies, no. 12*d*

12 Early whorls conspicuously convex, overhanging the suture. Abyssinia. *O. imbricata*, no. 7
Whorls moderately convex. Smyrna, Alexandria. *O. d. turcica*, no. 6*b*

13 Small, 2.5 to 6 mm. long; less than 3 wide; lamellæ enormously enlarged within; shell sometimes bristly. *O. raymondi* and varieties, no. 14
Larger, 7-12 mm. long, 3-5 wide (14)

14 Broad, diam. about 4.5 to 5 mm. (15)
Narrower, diam. about 3 to 3.5 mm. (16)

15 A long, immersed lower-palatal fold. Aleppo. *O. moussoni*, no. 13
No palatal fold (in forms examined). Cyprus, Syria. *O. sirianocoriensis* and varieties, no. 10

16 Sinistral; 7.5 x 3.5 mm. Adana, Cilicia. *O. s. heterostropha*, no. 12*a*
Dextral (17)

Base well rounded; no palatal fold; lamellæ very strong within. Upper Mesopotamia. *O. mesopotamica*, no. 9
Right margin of peristome thickened, tooth-like within; 9 x 3 mm., 11 whorls. Brussa, Asia Minor.
17 *O. scyphus*, no. 12
Last whorl tapering, compressed below; a long lower-palatal fold; 8.2 x 3.2 mm., 9½ whorls. Sert, Kurdistan. *O. s. palatalis*, no. 12*b*

1. ORCULA DOLIUM (Drap.). Pl. 1, figs. 1, 2, 3, 4.

The shell is deeply rimate, perforate, cylindric with short, conic summit and somewhat obtuse apex; russet or somewhat lighter, with a white area behind the lip; glossy; finely, irregularly striate. Whorls slightly convex, the last slowly ascending towards the aperture. Aperture truncate-oval, vertical, the peristome white, slightly expanded, thickened within. Parietal lamella entering spirally nearly one whorl, not reaching the edge of the thin parietal callus. Columella bearing two rather low lamellæ which are visible in direct front view but do not reach the peristome; these are subequal, or the lower one may be slightly stronger or more emergent. They ascend inward somewhat more than one whorl.

Length 6.8, diam. 3.4 mm.; 8½ whorls. Lyons.

Length 5.6, diam. 3.2 mm.; 8½ whorls. Lyons.

Middle and lower Rhone valley and Maritime Alps to the Carpathians; a subspecies extending northward in loess of the Rhine valley, another in Greece.

Pupa dolium DRAPARNAUD, Tabl. Moll. France, 1801, p. 58; Hist. Moll. Fr., p. 62, pl. 3, f. 43.—PFEIFFER, Monogr., ii, 325; iii, 540; viii, 368 (see for older references).—ROSSMAESSLER, Icon., pt. 5, p. 17, f. 330, 331. — REINHARDT, Sitzber. Ges. naturf. Freunde Berlin, 1880, p. 18 (distribution).—BRANCSIK, Jahresheft Trencsiner Comitates, x, 1887, p. 81, pl. 1, f. 11-19, with var. *titan*, forms *obesa, cylindrica, curta;* var. *minima*, with forms *obesa, cylindrica, curta.*

Orcula "doliformis Bruguière," LOCARD, Conchyl. Française, les Coq. Terr. de France, 1894, p. 322, figs. 450-1.

Orcula dolium Drap., Kobelt, Rossm. Iconographie n. F., viii, p. 76, pl. 262, f. 1499-1501 (references and varieties).

A somewhat strong shell, without epidermal threads, and having the lamellæ only moderately enlarged within. In the eastern Alps and beyond, it has numerous varieties. Many mutations, local forms and races have been named, but as yet not systematized. Mutations with the characters assigned to *major, minor, quadriplicata,* and the like, doubtless arose independently many times.

Terver found albino specimens near Lyons. He included them with colored ones in a lot sent to us, and probably they occurred in mixed colonies. However, Locard states that "cette jolie variété constituait une véritable colonie aux environs de Lyon au Vernay," which he says appears to have disappeared now (1880), or at least it has not been rediscovered. There is a beautiful albino from Styria in the B. Walker collection. Moquin-Tandon, 1855, has named a var. *minor,* shell smaller.

The following are described as "variations" in A. Locard's Etudes sur les Variations Malacologiques du Bassin du Rhone, i, 1880, pp. 256, 265. *Major:* shell 7-8 mm. long, of regular, cylindric shape, elongate and not ovoid, not very ventricose, with one or two columellar lamellæ. Rare, environs of Lyons. *Globulosa:* shell 6-7 mm. long, but perfectly ovoid, globulose, ventricose, with two columellar lamellæ. Not very common. Isère, Savoy. *Quadriplicata:* shell as in the type, but with 3 columellar lamellæ, the two first quite strong, the third rudimentary but readily visible. Environs of Lyons.

In the Kotlina valley and other places in the "Hohen Tatra," northern Carpathians, Hazay found three forms: (1) long and slender, 8 mm. long, 2⅓ broad, forma *gracilis;* (2) low, broad, 5 to 6 mm. long, 2½ wide, forma *tumida;* (3) a form intermediate in shape, 8 x 4 mm., to be regarded as typical (*Hazay,* Jahrb. D. M. Ges., xii, 1885, p. 31). These forms need comparison with those defined from the Tatra by Clessin and Brancsik in 1887.

Orcula dolium var. *triplicata* 'Brancsik' Clessin. Pl. 1, fig. 6. Shell broader and larger; columellar folds 3, a somewhat smaller third one being interposed between the first and second. Length 9, diam. 2½ to 3 mm. Upper Hungary at Trencsin-Teplitz (*Clessin*, Molluskenfauna, 1887, p. 235, fig. 138). This is the mutation called *quadriplicata* by Locard and Westerlund, occasionally occurring individually in some colonies of *dolium*.

Westerlund defines the following in his Fauna, iii, 1887, p. 84. Form *major:* Length 9 to 10, diam. 3½ to 3¾ mm. Hungary. *Obesa:* 8 x 4 mm. Hungary. *Par* Westerl.: both columellar lamellæ strong and produced forward to the margin equally strongly. No locality mentioned. *Cebratica* Westerl.: With two closely contiguous parietal lamellæ, the inner one smaller and less emerging. Cebrat Mt. (Jetschin).

The following forms from the Tatra were defined by Brancsik, Jahresheft Trencsiner Comitates, x, 1887, p. 81; as I have not seen this publication, the descriptions are taken from Kobelt's Iconographie, n. ser., vol. 8.

Var. *titan* Branc. With considerably widened umbilical perforation, more strongly striate, with conspicuously more robust figure; with form *obesa* (pl. 1, fig. 4) higher and broader, generally widest at base, length up to 11 mm., of 10 to 10½ whorls. Also forms *curta* and *cylindrica*.

Var. *minima* Branc. With noticeably reduced upper columellar fold, relatively strong peristome and strong callus, distinct striation and deeper suture; with forms *obesa, cylindrica* and *curta*.

Pupa dolium var. *cylindrica* Fitzinger, Beiträge zur Landeskunde Oesterreich's, iii, 1833, p. 108, no description.

1*a*. *Orcula dolium pfeifferi* (Moq.). Pl. 1, figs. 8, 9.

The shell is similar to *dolium* except that there is a single lamella on the columella. Within the last whorl the parietal lamella is very low, though about a whorl long, and on the axis only one columellar lamella; the supracolumellar being wholly wanting or represented by an inconspicuous swelling.

Length 6.8, diam. 3.3 mm.; 8½ whorls. Grenoble, type loc.

Length 7, diam. 3.2 mm.; 8⅔ whorls. Schwartzenberg am Pilatus.

Grenoble and Lyons, France; Switzerland.

Pupa dolium var. *pfeifferi* Moquin-Tandon, Moll. France, ii, 1855, p. 385, not *Pupa pfeifferi* Krauss.

Differs from *uniplicata* P. & M. by the stouter, normal shape of the shell, but perhaps intergrades with it. In a lot from Grenoble there are some with a very weak supracolumellar lamella, and also typical *dolium*.

1*b*. *Orcula dolium uniplicata* Pot. et Mich. Pl. 1, fig. 7.

Generally not so large as *dolium*, and differing by its more cylindric and more lengthened shape. It has only one fold on the columella. The striæ are finer and the epidermis more glossy. High mountains of the Austrian Alps (*P. & M.*). The figure measures, length 8, diam. 2.8 mm.

Pup. uniplicata Potiez et Michaud, Galerie des Moll. Douai, i, 1838, p. 176, pl. 17, f. 13, 14.

This is evidently a slender, glossy race of the eastern Alps. It is probably an error to apply the name *uniplicata* to *pfeifferi* Moq., also having a single columellar lamella, but a less lengthened shell.

1*c*. *Orcula dolium brancsikii* Clessin. Pl. 1, fig. 10.

Shell rimate, cylindric-conic, very long, with rather pointed apex; finely, irregularly striate, brown in color, translucent. Whorls 11, very slowly and regularly increasing, separated by a moderately deep suture, the last whorl composing a fifth of the shell's length. Aperture semi-ovate, with an arcuate parietal tooth and a columellar fold in about the middle of the columella. Peristome expanded and somewhat reflected, weakly thickened and white. Length 8, diam. 2.8 mm. (*Clessin*).

Upper Hungary at Manin in the Comitate Trencsin (Brancsik).

Orcula brancsikii Cless., Molluskenf. Oesterreich-Ungarns u. d. Schweiz, 1887, p. 236, f. 139.—*Pupa dolium* var. *elongata* Brancsik on label, according to Clessin. — *Pupa dolium* var. *kimakowiczi* Brancsik, Jahresheft Trencsiner Comitates, x, 1887, p. 81, with forms *elongata* and *curta* (not seen by H. A. P.).—*Orcula dolium* var. [*brancsiki*] Kobelt, Rossm. Icon., viii, p. 77, pl. 232, f. 1499.

Brancsik stated that he possessed all intergrades between this lengthened race and the typical *dolium*. The figure is copied from Kobelt, and represents a specimen from Brancsik.

1*d*. *Orcula dolium pseudogularis* Wagner.

Shell strikingly slender-cylindric, with thin, weakly-lipped peristome and often weak but always present upper columellar fold. Length 8, diam. 3 to 3.4 mm. (*Wagner*).

Lower Austria: Cliffs of the Tuerkensturz at Gleissenfeld in the Pittental.

Orcula dolium pseudogularis ANTON WAGNER, Verh. zool.-bot. Ges. Wien, lxii, 1912, p. 252.

The similar *Orcula dolium kimakowiczi* Brancsik = *Orcula brancsiki* Clessin, from the Manin gorge in northern Hungary also has a slender spire, which however tapers conically from the middle on; a strongly lipped, more expanded peristome, and also the upper columellar fold is constantly wanting (*Wagner*). Compare *uniplicata* P. & M.

1*e*. *Orcula dolium plagiostoma* ('Braun' Sandb.). Pl. 1, figs. 12, 13.

"Mostly smaller than the typical form, and having on the columella either only one lamella or none.

"Length 6-7, diam. 2½-3 mm." (*Sandberger*).

Length 6, diam. 2.8 mm.; 8½ whorls (fig. 13)

The small parietal lamella penetrates hardly half a whorl, and diminishes within. The low or obsolete columellar lamella is also short, not appearing on the axis within the last whorl. Umbilical perforation is small.

Mid-Pleistocene of many places from Alsace to Austria and Hungary.

Pupa dolium (var. *plagiostoma*) AL. BRAUN, Amtlicher Bericht xx Versamml. Ges. deutscher Naturf. u. Aerzte zu Mainz, 1842, p. 143 (1843), name only. — SANDBERGER, Vorwelt, p. 878, pl. 36, f. 21 (1875).

The degeneration of the lamellæ, especially striking when the shell is opened (fig. 12), seems to indicate specific distinction for this form; yet as only a single lot from the loess is before me, the range of variation and possible intergradation with *dolium* cannot be gauged. It is a problem for German and Austrian conchologists who have long series of specimens.

Sandberger, while figuring and describing the loess form, also referred to *plagiostoma* certain recent shells from some places in the Alps of Austria, Bavaria, Lombardy, Switzerland and France (Grenoble). Part of these probably belong to the var. *uniplicata* P. & M.; others certainly to var. *pfeifferi* Moq. This differs from *plagiostoma* by having the shape of typical *dolium*, and by the much stronger development of the lamellæ within the last whorl. I do not think them connected racially with the loess form.

In the loess, *plagiostoma* occurs as a pure race in, as well as northward beyond, territory where the typical *dolium* is found living. It is less elongate than the recent var. *uniplicata* P. & M., though often longer than the loess specimen figured.

Orcula dolium var. *implicata* 'Brancsik' Clessin. Pl. 1, fig. 5. Columellar folds indistinct, almost entirely wanting. Upper Hungary in the Comitate Trencsin at Vratna. (*Clessin*, Die Molluskenfauna Oesterreich-Ungarns u. der Schweiz, 1887, p. 234, fig. 136.) It may be surmised that this form is racially identical with *plagiostoma* Sandb., 1875.

1*f*. *Orcula dolium transversalis* (West.).

Shell umbilicate-perforate, obese, cylindric, the upper three whorls forming an extremely short cone. Nine to ten very slowly increasing, transverse, slightly convex whorls, separated by an impressed suture, everywhere horizontal except at the last whorl where it ascends; the last whorl short, dilated above at the aperture, basally rounded. Aperture small, subsemioval, at base outwardly narrowed, columellar margin somewhat straightened, vertical; lamellæ as in *dolium*, all marginal; peristome straight, acute, simple, connected by a wide parietal callus. Length 6¾, diam. 2½ mm. (*West.*).

Greece: Tschumerka, Mt. Pindus (Th. Krueper).

Pupa (*Orcula*) *transversalis* Westerlund, Nachrichtsbl. d. malak. Ges., xxvi, Oct. 1894, p. 171.

Hitherto no form of *dolium* has been found on the Balkan Peninsula, and this is so different from the type that one feels impelled to consider it a distinct species. It differs by its thick, entirely cylindric form (in *dolium* at least 5 upper whorls form a lengthened cone, or the whole spire is almost conic); by the more slowly increasing whorls, quite transversely placed, with horizontal suture, giving the shell a peculiar appearance, and by the small aperture with quite straight, simple lip, etc. (*West.*).

2. ORCULA GULARIS (Rossm.). Pl. 1, fig. 14.

The shell is minutely perforate, deeply rimate, cylindric, passing at the upper third into a convexly conic summit; chestnut brown, glossy, weakly, irregularly striate. Whorls slightly convex, the last slightly swollen and cream-white behind the lip, ascending a little to the aperture. Aperture truncate-oval, the peristome thin, *very little expanded*, pale brownish. Parietal lamella thin but high, emerging nearly to the edge of the thin parietal callus, and entering to the ventral side. Columellar lamella rather strong, not emerging to the lip; above it a smaller, more deeply placed supracolumellar lamella, visible only in an oblique view in the aperture, or sometimes wholly immersed. A short distance within the outer and basal margins there is a *strong white callus,* inwardly running into an entering lower-palatal fold, strong or weak.

Length 6.5, diam. 2.6 mm.; 9 whorls.

Mountains of Carinthia, Carniola, southern Tirol, Steiermark; type locality on the Loibl, in Carinthia, at about 3000 ft., on limestone blocks in turf of alpine plants, chiefly *Globularia cordifolia* (Rossmaessler).

Pupa gularis ROSSMAESSLER, Iconographie, i, pt. 5, 1837, p. 17, pl. 23, f. 333; with var. *spoliata* Rm., p. 18, pl. 23, f. 334.—PFR., Monogr., ii, 326; viii, 368.—KUESTER, Ber. nat. Ges. Bamberg, x, 1875, p. 58.—REINHARDT, Jahrb. d. m. Ges., 1877, p. 282, footnote (armature of young); Sitzungsber. Ges. naturf. Freunde, Berlin, 1880; p. 20 (distribution).—*Orcula gularis* Rossm., TSCHAPECK, Nachrbl. d. m. Ges., xix, 1887, p.

79 (Grimming, Alpe Lawinenstein, cliffs of Altausseer Lake, Steiermark).

Pupa pollonerœ PINI, Atti. Soc. Italiana di Sci. Nat., xxvii, 1884, p. 79, fig. (Val di Non, Tirol); *cf.* GREDLER, Nachrbl. d. m. Ges., xvii, 1885, p. 38 (as a synonym of *P. gularis* var. *spoliata*).

Distinguished by the palatal callus, from which, except in var. *spoliata,* a lower-palatal fold runs inward. It is usually more slender than other species of the region.

O. gularis in the young stage has lamellæ, that of the parietal wall showing knots exactly as in *O. doliolum,* according to Reinhardt.

2*a*. *O. gularis restituta* (Westerlund).

Two columellar lamellæ long, strong, parallel, running to the margn. Carinthia, Feestritz valley at Stein (*Westerlund*, Fauna, iii, 1887, p. 85).

2*b*. *O. gularis spoliata* (Rossm.). Pl. 1, fig. 15.

No palatal fold; neck more swollen (*Rossm.*).

Tyrol Alps (Rossm.); Val di Non, Nonsberg, Tyrol, for *P. pollonerœ*). Central Carpathians. Galizian side of the Tatra, Rosenberg and other places in the Waag valley (Reinhardt).

A specimen from Dennberg, Tyrol, received from the Boettger collection, is figured. It is but slightly swollen behind the aperture, and measures, length 5.3, diam. 2.6 mm., 8½ whorls.

Gredler has shown that *P. pollonerœ* Pini is identical with *spoliata*.

2*c*. *Orcula gularis pseudodolium* Wagner.

Shell larger, more ventricose, more strongly striate than in the typical form from Carinthia, and thus strikingly recalling *Orcula dolium*. Also the upper columellar fold is stronger, emerging further, and also distinctly visible in a direct view in the aperture; often as strongly developed as in *O. dolium* Drap. The palatal callus is as strong as in *O. gularis spoliata* R., but with a short, fold-like extension; the peristome more expanded. Length 7, diam. 3 to 3.5 mm. (*Wagner*).

Upper Austria: Feuchtenauer Alm am Hochsengsengebirge bei Windischgarsten.

Orcula gularis pseudodolium ANTON WAGNER, Verh. k.-k. zool.-bot. Ges. Wien, lxii, 1912, p. 252.

2*d*. *Orcula gularis tolminensis* Wagner.

Shell smaller, darker reddish-brown, with weak, often nearly obsolete columellar folds, which are not visible in a direct front view in the aperture. The strong palatal callus has a very long, fold-like extension [lower-palatal fold], which reaches over a half-whorl to the umbilical crevice. Length 5.5, diam. 2.3 mm.

Italy: At the waterfall Pericnik at Tolmein in the Isonzo valley.

Orcula gularis tolminensis ANTON WAGNER, Verh. k.-k. zool.-bot. Ges. Wien, lxii, p. 253.

3. ORCULA CONICA (Rossm.). Pl. 1, figs. 16.

The shell is perforate, ovate-conic, ventricose, thin, horn-brown, very finely striate, slightly glossy, scarcely translucent. Whorls 9, very slowly increasing, strongly convex; suture deep. Neck but little swollen. The aperture is obliquely semi-ovate, somewhat triangular. Peristome somewhat expanded, simple, sharp. On the parietal wall one, on the columella two lamellæ (*Rossm.*).

Length 5.5, diam. 2.8 mm.; 9 whorls.

Steiermark; Illyria; Schottwien to Laibach, especially Klagenfurt (Rossmaessler); Friaul at Mernicco, Croatia at Podsused and at the waterfall at Plitvice (Reinhardt). Kapellengebirge, southern Croatia (Reitter).

Pupa conica ROSSMAESSLER, Iconographie, i, pt. 5, 1837, p. 17, pl. 23, fig. 332. — PFR., Monogr., ii, 325. — KUESTER, Conchyl. Cab., p. 23, pl. 3, f. 13, 14. — REINHARDT, S. B. Ges. naturf. Freunde, Berlin, 1880, p. 19. — BOETTGER, Bericht Offenbacher Ver. Naturk., 1880, p. 109.—*Orcula conica* CLESSIN, Molluskenfauna Oesterreich-Ungarns, p. 238, fig. 141 (details of distribution).

In this species the *upper half is strongly conic*, the last whorl very short, not dilated below towards the aperture, but the suture ascends strongly near its termination. The whole shell is quite thin. The lip is slightly expanded, without internal callus. The thin, high parietal lamella emerges to the edge of the thin parietal callus. Inside it becomes wider, flaring, with somewhat waved free edge, penetrating to the ventral side. The columellar lamella emerges to the peristome and is strong within the last whorl on the left side. The supracolumellar lamella is weaker and shorter.

In specimens seen the length varies from 5 to 6 mm. It is sometimes a little narrower and more cylindric than in the shell figured.

4. Orcula schmidtii (Kuester). Pl. 1, fig. 11.

The shell is ovate-conic or shortly cylindric, very obtuse, broad above, with a dull luster, very finely ribbed, the riblets oblique and epidermal, as in *P. doliolum*. The umbilicus is round and deep. The 8-9 whorls are slightly convex, very low, increasing only very gradually in height and united by a simple, impressed suture. Aperture rather large, semi-ovate, nearly rounded-triangular. Peristome sharp, only slightly expanded, scarcely thickened, sometimes connected with the very large oblique parietal lamella by a very thin callus. Columella with two horizontal folds, the upper one generally larger. Of a corneous brownish-red, the apex paler; aperture dirty flesh-color, peristome and lamellæ white. Length 1.8 to 2.5, diam. 1.33 lines (*Kuester*).

Length 5.2, diam. 3 mm.; 8¾ whorls.

Montenegro: Cettinge, under stones on limestone cliffs (Kuester, June, 1842); Western Montenegro (Reitter).

Pupa schmidtii Kuester, Syst. Conch. Cabinet, Pupa, ..., p. 26, pl. 3, f. 20-23; Ber. nat. Ges. Bamberg, ix, 1870, p. 98. —Pfr., Monographia, ii, 327. — *Orcula schmidti* Boettger, Bericht Offenbacher Ver. Naturkunde, 1880, p. 109.

The parietal lamella becomes low within the ventral part of the last whorl, both columellars being strongly developed there.

This rare species is smaller than *O. dolium*, more strongly sculptured, with stronger, more emerging columellar lamellæ, and without a callus within the outer lip. It is less conic than *O. conica*, and differs by its epidermal riblets, but this is the most closely related species. Figured from a specimen from the Boettger collection.

5. ORCULA JETSCHINI Kim. Pl. 2, figs. 10, 11.

Shell perforate, somewhat swollen-cylindric, yellowish-brown, often with a reddish tint, dully shining, with more or less separated cuticular riblets. Summit bluntly conic, nearly hemispherical. The 9 convex whorls increase slowly but regularly in width, and are separated by a rather deep suture. Aperture somewhat inclined to the axis, truncate-ovate, with three folds: the largest on the parietal wall, two emerging to the margin on the columella. Peristome somewhat expanded, chiefly on the columellar margin, with a white thickening within. Length 6½ to 7, diam. 3½ to 3⅔ mm. (*Kim.*).

Transylvania, restricted to the southwestern part: Vajda-Hunyad and Bad Gyogy (Kimakowicz), Judenberg near Zalatna (Jickeli). Cerna valley at Mehadia in the Banat (Jetschin).

Orcula jetschini M. v. KIMAKOWICZ, Verh. u. Mitth. Siebenb. Ver. naturwiss. im Hermannstadt, xxxiii, 1883, p. 44; also xxxix, 1889, p. 98.—CLESSIN, Molluskenfauna Oesterreichs, etc., p. 237, f. 140.

O. jetschini is related to *O. conica*, both having the parietal and columellar lamellæ very broadly expanded within; but *jetschini* has an irregularly-ribbed surface, while *conica* is finely striate, like *dolium*. *O. schmidti* has closer, finer epidermal riblets, and the lamellæ are less enlarged within, the supracolumellar being nearly as large as the columellar.

When young *O. jetschini* is plastered with dirt both above and below; on the early whorls this layer projects over the suture.

The specimens figured are from near Mehadia.

6. ORCULA DOLIOLUM (Brug.). Pl. 2, figs. 1, 2, 4.

The shell is imperforate, rimate, cylindric or widest in the upper third, terminating above in a very short, convexly conic or dome-shaped summit; very pale brown (or often whitish). Surface somewhat glossy, having numerous narrow cuticular riblets, more or less widely spaced. The whorls are slightly convex, the last flattened laterally, the suture ascending strongly to the aperture. The aperture has a broadly reflected white peristome, well thickened on the face and within, causing a narrow, opaque buff streak behind the outer lip. The parietal lamella emerges very nearly to the edge of the very thin parietal callus, and penetrates more than a whorl inward. It becomes more or less lower at the back, enlarging again towards its inner end. There is a small nodular angular lamella, slightly separated from the termination of the outer lip. Columellar lamellæ two, immersed, the lower one stronger, upper weak and more immersed (sometimes obsolete or not visible in a front view). They penetrate slightly more than one whorl, and within the back are subequal, or the lower a little larger.

Length 5, diam. 2.3 mm.; 8½ whorls.

Length 4.2, diam. 2.3 mm.; 7½ whorls.

Middle and southern Europe, nearer Asia; from France to Asia Minor, Armenia and the Caucasus region, east to Talysch and northern Persia. Type loc., environs of Paris.

Bulimus doliolum BRUGUIÈRE, Encyclopédie Méthodique, i, 1792, p. 351.—*Pupa doliolum* DRAPARNAUD, Hist. Moll. Fr., p. 62.—ROSSMAESSLER, Iconogr., i, p. 5, p. 16, f. 328, 329.—PFR., Monogr., ii, 326; iii, 540; iv, 667; vi, 305; viii, 368 (see for older references).—Moquin-Tandon, Moll. Fr., p. 385, pl. 27, f. 32-34. — WESTERLUND & BLANC, Aperçu Fauna Malac. Grèce, 1879, p. 101 (Grecian records). — BOETTGER, Jahrb. d. m. Ges., vi, 1879, p. 32 (Caucasian forms); Jahrb. d. m. Ges., viii, 1881, p. 229 (Borsham, Schambobel, coast between Suchum and Poti). — PAULUCCI, Bull. Soc. Malac. Ital., vii, 119, 1881, with forma *curta*, p. 120 (dist. in Italy).—*O. doliolum* VOHLAND, Sitzungsber. u. Abh. Nat. Ges. Isis, in Dresden, 1911, p. 126 (distribution in Germany). — BOETTGER, Ber. Senckenb. Ges., 1888-9, 23 (Caucasian references); Zoologischer Jahrb., iv, 1889, p. 958 (Persia).

Helix coronata STUDER, in Coxe's Travels in Switzerland, iii, 1789, p. 386, no description; based upon Geoffroy's no. 19, *Le grand Barillet,* Traite som. Coq. env. Paris, 1767, p. 56.

JUVENILE STAGE. — *Helix templorum* BENOIT, Illustr. sist., crit., iconogr. Testac. estramar. Sicilia, 1857, p. 194, pl. 8, f. 2; *cf.* REINHARDT, Jahrb. d. m. Ges., iv, 1877, p. 277. — *Helix villosula* Kokeil, GALLENSTEIN, Kärntens Land- und Süsswasser-Conchylien, Jahrb. naturhist. Landesmuseums von Kärnten, 1852, p. 64 (in der Satnitz; *P. doliolum* also there, p. 78). — *Helix spinosa* FÉRUSSAC, *olim,* according to Hartmann, Pfr., Monogr., ii, 327 (not traced by H. A. P.).

This common shell differs from the larger forms of the *dolium* group inhabiting part of the same region by its smaller diameter and well-reflected lip. The similarly shaped *O. scyphus graecus* does not have spaced epidermal riblets, and the lamellæ are more enlarged within the last whorl.

Piaget (Ann. Mag. N. H., 2d ser., xiii, p. 456) was, I believe, the first to notice that four or five upper whorls of young specimens are furnished with epidermal ribs terminating just above the suture in short, triangular spines. These are usually worn off in the adult stage. The supposed species *Helix villosula* and *templorum* were founded upon this early neanic stage.

The earliest name for this species appears to be *Helix coronata* Studer. It rests upon a description of Geoffroy, which seems to me quite sufficient. However, since European students appear to have thought otherwise, I hesitate to substitute that name for the universally used *doliolum.*

Many mutations, ecologic or local forms have been named, most of them probably not races, but included here for what they are worth.

Locard defined the following variations in Etudes Variations Malacologiques, i, 1880, p. 267, under *Pupa doliolum:*

Major Loc. Shell measuring more than 7 mm. long, nearly cylindric, quite regular, slightly more swollen above, covered with low striæ. Environs of Lyons and Grenoble.

Minor Loc. Smaller than the type but with the same number of whorls, not over 4 mm. long, short, compact, swollen above, striæ well marked. Environs de Lyon, le bas Bugey.

Biplicata Loc. Shell like the type in shape, but with only one columellar fold visible, the second obsolete or reduced to the condition of a mere prominence and hardly visible. Les alluvions du Rhone à Lyon.

Moquin-Tandon (Moll. Fr., ii, 1855, p. 386) noticed a var. *albina* (Menke, Syn. Moll., p. 33), with the shell whitish, from the valley of Campan.

Pupa doliolum form *curta* Paulucci is said to be entirely like the typical form with which it occurs, but the shell shorter. Abruzzo or Umbria, Italy. Bull. Soc. Malac. Ital., vii, 1881, p. 120.

The following descriptions of local forms from France are taken from A. Locard's Conchyliologie Francaise: les Coquilles Terrestres de France, published separately 1894, and in Annales Soc. d'Agriculture, Sci et Ind. de Lyon (7 sér.), vols. i-iii; the Pupillidæ in vol. iii, for 1895, dated 1896. As the two publications were printed from the same type, with merely change of pagination, there may be some doubt about the date 1894. Perhaps the separates were published in advance of Vol. 3 of the Annales.

All but one of the ''species'' are ascribed to Bourguignat *in coll.* The descriptions are by Locard, but who can blame him for trying to shift responsibility for them?

The following are on page 323 of the Coq. terr. separate; page 211 of the Annales:

Orcula alpium 'Bourguignat' Locard. Nearly cylindric, narrowly elongate, a little tapering at base; 10 slightly convex whorls, suture little marked. Aperture narrowly ovate; one quite strong median fold above, two immersed columellar folds. Peristome expanded, reflected, not very thick. Shell reddish-corneous with little gloss, ornamented with strong, regular striæ. Length 5½ to 6, diam. 2¼ mm. Rare; clus de St-Auban, Saorgio, de Fontan à Damas (Alpes-Maritimes).

Orcula sublaevis 'Bourguignat' Locard. Nearly cylindric, a little tapering at base; 8 very slightly convex whorls, suture very mediocre. Aperture oboval-rounded; one large and thin median lamella above; only one quite small and deep-seated columellar. Peristome interrupted, expanded, reflected, a little thickened. Shell light corneous-reddish, little shining, ornamented with more or less obsolete striæ. Length 5½ to 6, diam. 2 mm. Rare. Menton (Alpes-Maritimes).

Orcula saint-simonis 'Bourguignat' Gourdon (1881). Subcylindric, a little elongate, tapering towards the base; 10 slightly convex whorls, suture little marked. Aperture oboval-rounded; one large, thin superior lamella, two immersed columellars, the lower more robust; peristome reflected, a little thickened. Shell ornamented with spaced, lamellar, sinuous striæ, of a pale corneous or grayish color. Length 5½ to 6, diam. 2½ mm. Not common; Haute-Garonne, Lot-et-Garonne, etc. (*Locard*).

O. saint-simonis was first noticed under the name *P. doliolum* by Saint-Simon (Moll. Pyr. Haute-Garonne, 1876, p. 16, not seen by H. A. P.), who pointed out the differences of this Pyrenean race from typical *doliolum*. Gourdon (Bull. Soc. d'Hist. nat. Toulouse, xv, 1881, p. 93) adopted, without description, Bourguignat's name for the form defined by Saint-Simon. Type locality "Tour de Castel-Blancat, environs de Luchon."

Orcula macei 'Bourguignat' Locard. Very long subcylindric, quite strongly tapering at the base; 10 slightly convex whorls, the suture little marked. Aperture relatively small, rounded, a little retracted at the base. One quite strong median lamella above; one immersed columellar, robust and quite arcuate. Peristome reflected, not very thick. Shell ornamented with fine, close, slightly sinuous striæ, of a corneous grayish color. Length 5½ to 6½, diam. 2 mm. Quite rare; clus de St-Auban, Briançonnet, Alpes-Maritimes, env. de Lyon.

The following are on p. 324 of the Coq. terr. separate, and on p. 212 of the Annales:

Orcula bourguignati 'Mace' Locard. Subcylindric, short and squat, tapering quite strongly at the base. Eight slightly convex whorls, the suture little marked. Aperture oboval, rounded at base. One moderate superior lamella, quite strong and very arcuate; two immersed columellars, the lower more robust. Peristome expanded, reflected, not very thick. Shell light corneous, ornamented with fine, spaced striæ. Length 5, diam. 2½ mm. Rare; Briançonnet, clus de St-Auban, Menton (Alpes-Maritimes).

Orcula macrotriodon 'Bourguignat' Locard. Small, cylindroid, very short and squat, tapering at the base. Eight quite convex whorls, the suture marked. Aperture somewhat rounded. One strong and very arcuate median lamella above; two immersed columellars, the lower robust and arcuate. Peristome expanded, reflected, a little thick. Shell corneous-reddish, ornamented with fine, little marked, quite spaced striæ. Length 4¾, diam. 2¾ mm. Rare; Santa-Clara, vallée de Cairos, près Saorgio (Alpes-Maritimes).

Orcula doliolum var. *tumida* Vohland. Shell globose-cylindric, much more inflated than the type, with small, oblique umbilical crevice. The ribbing (only exceptionally well preserved), sharp, regular. Where the shell is worn a very fine striation shows. Whorls only 8 (against 9 or 10 in the type), the greatest thickness more towards the middle, then rapidly diminishing, much more closely coiled. Last whorl rising strongly towards the aperture, which is like the type. Length 4, diam. 2.5 mm. Pleistocene of the Wilden Sau. flowing into the Elbe below Dresden. (VOHLAND, Sitzungsber. u. Abh. nat. Ges. Isis, in Dresden, for 1910, p. 126; 1911.)

The Sicilian form of *doliolum* (*O. d.* var. *templorum*, pl. 2. fig. 3, Catania) is very close to the typical form. It has *no* angular tubercle and the columellar folds emerge only far enough to be visible from in front. Shell light brown. The early neanic stage has been described as *Helix templorum* Benoit, from the temple of Selinunte in southern Sicily. He also figured Sicilian *O. doliolum* on his pl. 5, f. 19, but did not reach this species in the text.

Dr. Boettger reports the form from Schah-rud, Prov. Irak Adschmi in northern Persia, as similar to that of the Talysch, brownish-yellow, the whorls more weakly convex than in the type, a distinct angular nodule, two columellar lamellæ; lip very thick, callous, white. Length 5.5, diam. 2.5 mm.

Form *unifilaris* (Boettger). Dr. Boettger writes (Jahrb. d. m. Ges., vi, 32) of Caucasian *doliolum* that in the narrow form (compared to German examples) of Mamudly, 2-2¼ mm. in greatest diam., and the strongly elongate, rather narrow examples of Zalka (6 x 2½ mm.) all of the many specimens show only one columellar lamella. Of the specimens equal to the German in width, also numerous from Kasbek (2¼-2½ mm. diam.), two-thirds are provided with one, only one-third with two columellar lamellæ. In all Caucasian examples before me, he continues, the sculpture appears somewhat weaker in adults than in those of Germany and Sicily.

On the preceding page (31) Boettger had suggested that the form with a single fold might be called *unifilaris*. This name was proposed in a casual and tentative manner, in a paragraph mainly discussing *bifilaris* Mouss., so that Kobelt (Iconogr. n. F., viii, 1899, p. 76) erroneously supposed that *unifilaris* was a form of *bifilaris*. Zalka may be considered type locality for *unifilaris*, if it turns out to have any racial value.

Retowski notes that the specimens from Samsun belong to the small form not uncommon in the Caucasus, all having two distinct columellar lamellæ.

6*a*. *Orcula doliolum tereticollis* West.

Shell short, obese, rounded-conic at apex, more strongly and distantly lamellose-costulate; whorls 8, very slowly increasing, the last very narrow behind, not higher than the penult, terete (not slowly, obliquely tapering downwards); aperture semirotund, the parietal lamella long, one columellar, thin, situated above, somewhat produced outward, peristome widely spreading, outwardly thin. No punctiform angular tooth (always present in the typical form). Length 4, width 1⅔ mm. Northern Persia, Siaret, one specimen, Keyserling and Bienert [*Pupa* (*Orcula*) *doliolum* var. *tereticollis* Westerlund, Annuaire Mus. Zool. Acad. Imp. Sci. St. Pétersb., i, 1896, p. 195].

6*b*. *Orcula doliolum turcica* 'Bgt.' Let. Pl. 2, figs. 5, 6.

Long, cylindric, pale brown somewhat translucent, sharply, finely striate above, the cylindric part weakly so; in the most perfectly preserved individuals having delicate, well-spaced cuticular riblets, more or less distinctly legible. Suture impressed, shortly but rather steeply ascending to the aperture in some examples, very slightly and slowly in others. Peristome white, narrowly reflected, a little thickened within; parietal callus thin, tuberculate next to the lip-insertion. Parietal lamella of medium size, tapering in front, emerging nearly to the edge of the parietal callus. It continues nearly of equal height to the inner end. Columellar lamellæ are not visible in the mouth in some individuals (typical, according to Letourneux), but in others the lower one is weakly visible, or two very low subequal ones may be seen. Inside there are two nearly equal and not very large, parallel columellar lamellæ. No palatal fold.

Length 6.3, diam. 2.5 mm.; 8⅓ whorls. Smyrna.

Length 5.2, diam. 2.3 mm.; 7½ whorls. Smyrna.

"Length 6.5, diam. 2.25 mm.; 9 whorls" (*Letourneux*).

Santorin, one specimen at Messa Vouno; common around Smyrna (which is here designated as type locality); Rhodes; thrown up on the beach of Ramlé near Alexandria (Letourneux).

Orcula turcica ("Bourguignat, Species noviss. Moll. in Eur. syst. detect., 1878, no. 153"; never published) LETOURNEUX, Bull. Soc. Malac. France, i, 1884, p. 298.—*Orcula scyphus* PALLARY, Mém. Inst. Egyptien, vi, pt. 1, 1909, p. 41, pl. 3, f. 22.

Usually of long form with over 8 whorls, though sometimes shorter; rarely showing the spaced riblets of *doliolum* in adult shells; with receding columellar lamellæ, weakly or not visible in the mouth. The parietal lamella of typical *doliolum* becomes lower in the back, stronger again toward its inner end. In *turcica* it remains nearly equal in height throughout. *O. d. turcica* appears to me to be a recognizable race, and certainly has nothing to do with *scyphus*. Figured from Smyrna topotypes received from Jetschin.

Pupa critica Zelebor (PFEIFFER, Malak. Blätter, iii, 1856, p. 177, as a variety of *doliolum;* Monogr., iii, 540) has never been fully described. In his notes on the shells collected by J. Zelebor (preparator of the k. k. Hof-Naturalienkabinet in Vienna) on the island of Syra, in the Grecian Archipelago, Pfeiffer says:

> *Pupa doliolum* Brug. "Under stones and on roots, rare." A variety with the columellar fold very little developed, which was indeed named *Pupa critica* by Mr. Zelebor, but which is certainly not separable from *doliolum*.

Both *doliolum* and "*scyphus*" have been reported from Syra by Westerlund and Blanc (Aperçu sur la Fauna Malac.

de la Grèce, 1879, p. 101), but just what these authors had remains uncertain. It is quite possible that *critica* was the form now called *turcica*. As it was quite insufficiently defined, the name should be dropped. Several forms with little-developed columellar folds have been fully described since *critica* was published.

7. ORCULA IMBRICATA (Jickeli). Pl. 2, figs. 7, 8, 9.

Shell rimate, obovate-cylindric, with oblique membranous riblets, rather thin, brown. Spire long with obtuse apex, of 9 somewhat flattened whorls, imbricating below, the last one-third the length. Suture deepened. Aperture rounded-oval, biplicate; one oblique high fold on the parietal wall, deeply entering; one inconspicuous columellar. Peristome dilated, reflected, the margins converging. Length 5, diam. 2.5; aperture, alt. 2, width 1.75 mm. (*Jickeli*).

Abyssinia: Province Hamaszen, on the way from Genda to Asmara, under stones (Jickeli). Senafé, Adigrat, Agula and Meshek (Blanford).

Eritrea: Agame, Adi-Guden and Monte Cherseber (Boccardi).

Pupa imbricata JICKELI, Malak. Bl., xx, 1872, p. 107; Moll. nordost-Afr., in Nova Acta k. Leop.-Carol. deutschen Akad. Naturforscher, Bd. 37, p. 115, pl. 5, f. 7.—POLLONERA, Boll. Mus. Zool. Anat. Comp. Torino, xiii, no. 313, p. 5.—*Pupa* n. sp. near *doliolum* BLANFORD, Obs. Geol. and Zool. Abyssinia, 1870, p. 477, no. 15.

This species stands very near *O. doliolum,* but it differs, as Jickeli pointed out, by the very convex whorls of the upper part of the spire, which overhang the suture. The last whorl ascends slowly but considerably, and has a well-rounded base. The peristome is well reflected, white, not much thickened. Parietal callus thin, with a *very weak* angular tubercle or none. The parietal lamella emerges to the edge of the callus. It is high within the last whorl, and penetrates 1¾ whorls inward. The columella shows one or sometimes two low lamellæ in the mouth, becoming stronger within the back than in *doliolum,* the lower one stronger than the upper. The surface is dull, light brown or sometimes whitish. The epidermal riblets are very delicate, irregularly developed in some specimens, nearly regular in others. Specimens seen vary in form from cylindric to wider above, and in size from length 5.5, diam. 2.3 mm., of 8½ whorls, to 4.7 x 2.2 mm., barely 8 whorls.

It seems to be generally spread in northeastern Abyssinia and adjacent highlands. Blanford's *Pupa* no. 15 is a rather narrow form of this species according to specimens seen, figs. 7, 8. The original figure of *imbricata* are reproduced in fig. 9.

8. ORCULA BULGARICA Hesse.

Shell with closed umbilicus, cylindric, with conically tapering spire, sculptured with close, oblique rib-striæ which are rather strongly developed on the upper whorls, while they almost disappear on the last; dark horn-color, whitish near the aperture. Nine to ten convex whorls, separated by a rather deep whitish suture, the last rather strongly ascending to the aperture. Aperture semiovate-rounded, the margins widely separated, connected by a flat whitish callus: outer margin arcuate, especially in its upper part; columella vertical, somewhat rounded, smooth or with a weak angle, but without folds. The dentition is restricted to a somewhat receding, pretty low and short parietal lamella; it begins about 1 mm. from the margin of the callus, terminating steeply in front, diminishing quite gradually behind, and does not penetrate far inward. Peristome whitish, reflected, somewhat thickened. Length 6.5, diam. 3 mm.; height of the mouth 2.2 mm. (*Hesse*).

Bulgaria: drift of Devna lake at Gebedsche, near Varna (Prof. Herm. Skorpil).

Orcula bulgarica HESSE, Nachrichtsblatt d. malak. Ges., vol. 47, June 1915, p. 62.

Orcula bulgarica recalls *O. dolium* in size and habit, but in place of the umbilicus it has only a closed crevice. It differs from all species of the genus yet described by the low, relatively short parietal lamella and the complete lack of columellar folds (*Hesse*).

One fresh and two bleached specimens found. The lamellæ must resemble those of *O. dolium plagiostoma* rather closely, but the closed umbilicus and reflected lip are characters of the *doliolum* group. It has not been figured.

9. Orcula mesopotamica (Mouss.). Pl. 2, figs. 12, 13.

Shell shortly rimate, cylindric, rather solid, obliquely lightly striatulate, glossy, pale or corneous. Spire closely coiled, terminating in a short, obtuse cone, the summit rather obtuse, not projecting. Suture more impressed on the cone, less afterwards. Nine whorls, the first ones rather convex, with strong, membranous striæ, the following whorls slowly increasing, flattened, smooth; last whorl diminishing a little, ascending, forming one-third the length, rounded at base. Aperture subvertical, with a single compressed parietal lamella, not produced, and two short columellar lamellæ. Peristome expanded, somewhat reflected, rather obtuse, white-lipped within, the margins remote, joined by a callous layer thickened at the insertion; right margin regularly curved, not thickened in the middle nor impressed outside; columellar rather straight, spreading. Length 7-8, diam. 3 mm. (*Mousson*).

Upper Mesopotamia, from the plain of Haleb to Biredschek (Biredjik; here selected as type locality) and Siverek (Suverek), Dr. A. Schlaefli.

Pupa (*Sphyradium*) *scyphus* Friv. var. *mesopotamica* Mousson, Journ. de Conchyl., xxii, 1874, p. 31.

The figures were drawn from a Biredjik specimen from Mousson. It is quite thin, very light brown, obliquely striate, the striæ closer on the cone, where the whorls are quite convex. Later the whorls become only weakly convex, but the suture is well impressed throughout. The apical cone is very short. Last whorl ascends very little in front and is *broadly rounded at base.* The white peristome is expanded and *well reflected,* with some inner thickening. Parietal callus thin, bearing a tubercle at the insertion of the outer lip. The parietal lamella is well developed, not emerging to the edge of the parietal callus, penetrating one whorl, very strong towards its inner termination. Columella with two lamellæ, the lower strong, upper receding, very weak in front, interrupted within. Internally (fig. 12) the columellar lamella becomes *very strong on the left side,* where the supracolumellar also is strengthened. There is *no trace of an internal lower-palatal fold.* Length 7.5, diam. 3.2 mm., 9½ whorls.

O. mesopotamica is thinner, not so broad as *O. orientalis,* and differs (from the form *coerulescens,* which alone I have opened) in the shape of the inner end of the parietal lamella. The two species appear to be quite distinct. It needs comparison with the typical form of *O. scyphus* described by Pfeiffer, but that appears to be a more elongate shell of more whorls, the last one compressed basally, the outer lip thickened within.

10. Orcula sirianocoriensis (Mousson). Pl. 5, figs. 8.

Shell larger [than *O. dolium*], shortly rimate, regularly cylindric, the summit very obtuse; aperture a little inclined, retracted, the margins subparallel (*Mousson*).

Shell nearly cylindric, whitish-corneous, rimate, slightly dilated above, the summit convexly conic, apex obtuse. Whorls 10, very slowly increasing, scarcely convex, the upper 5 obliquely costellate, the narrow costellæ narrower than the interstices, lower whorls striatulate, the last narrowed basally, hardly one-third of the total length, ascending a little in front. Aperture truncate-oval. Parietal lamella high, the columellar slightly visible in an oblique view (distinct in young specimens). Peristome white-thickened, the margins converging, hardly connected, the outer margin thin above, then rapidly thickening. Parietal wall usually having a tubercle at the insertion of the outer lip. Length 9, diam. 4.5 mm. (*Kobelt*).

Cyprus; apparently rather generally distributed but nowhere abundant; type loc. in debris of the river of Sirianocori.

Pupa dolium var. *sirianocoriensis* Mousson, Mittheil. Naturforsch. Ges. in Zurich, iii, no. 102, 1854, p. 386.—*Pupa* (*Orcula*) *sirianocorensis* Kobelt, Rossmaessler's Iconographie

Eur. Land- u. Süsswasser-Moll., n. F., 1er Suppl.-Bd., 1897, p. 59, pl. 14, f. 9-9*b*.

Kobelt's figures and description of Cyprus specimens are given above, as no shells from Cyprus are accessible to me. Mousson's definition was quite inadequate, but his form has generally been placed under *orientalis* of Syria as a synonym or variety. Until further comparison can be made, including an examination of the internal structure, the status of the several forms following remains uncertain.

10*a*. *Orcula s. orientalis* ('Parr.', Pfr.). Pl. 5, fig. 5.

Shell long-rimate, subcylindric, rather solid, obliquely striatulate, silky, corneous. Spire thickened above, the vertex mucronulate-convex. Whorls 10, the upper 5 a little convex, rib-striate, the rest flattened; the last whorl not reaching one-third of the total length, somewhat ascending in front, rather compressed basally. Aperture oval, with a compressed, deeply entering parietal lamella; columella biplicate above. Peristome thin, the right margin slightly expanded, columellar margin dilated. Length 12, greatest diam. (near apex) 5 mm.; aperture with perist. 4 mm long, 3¼ wide (*Pfr.*).

Nazareth (Parreyss). Said to occur in Syria and the Lebanon.

Pupa orientalis Parreyss in coll., Pfeiffer, Malak. Blätter, viii, 1861, p. 168, pl. 3, f. 6-8; Monogr., vi, 305; viii, 367.—Mousson, Journ. de Conchyl., xxii, 1874, p. 31, var. *nitida*.—*Pupa* (*Orcula*) *doliolum* Brug. var. *orientalis* Parr., Naegele, Nachrbl. d. m. Ges., xxxiv, 1902, p. 7.—*Orcula orientalis* (P.), Boettger, Nachrbl., vol. 37, p. 107.—Germain, Voy. Kerville: Moll. terr. et fluv. Syrie, i, 1921, p. 327.

Reinhardt (1880) writes that the true *P. orientalis* has a club-shaped shell, which ranges it in the *doliolum* group. Its nearest relative is *mesopotamica* Mousson, which is considerably smaller, with more convex whorls.

Naegele (1902) reported numerous recent specimens from Akbes in Syria, differing from typical *orientalis* by their great size and single columellar lamella. Boettger, with the same material, states that all the examples have two well-developed columellar folds. Length 10, diam. 4.5 mm.

The original locality, Nazereth, is dubious, but doubtless it occurs in Palestine.

Var. *obesa* Blanck. More egg-shaped than club-shaped, 11 mm. long, 5 in diameter; columellar margin more oblique than in the type of the species. The true *P. orientalis* is otherwise not now known from Syria, as the specimens cited under this name from Aleppo by Mousson do not belong to it, according to Reinhardt, and have been distinguished by him as *P. moussoni* Reinh. Syria: Bab el Haua between Djisr el Hadid in Antiochia and Bet el Ma. 3 (*Pupa orientalis* var. *obesa* Blanckenhorn, Nachbl. d. mal. Ges., xxi, June 1889, p. 79). The name is preoccupied.

Var. *nitida* Mousson. Straightly cylindric, lower whorls scarcely striatulate, glossy; aperture broadly semiovate; 2 distinct folds on the columella. Slope of the littoral range of Haleb, upper Mesopotamia, Dr. Schlaefli (*Mousson*).

Var. *cedrorum* West. Shell very widely rimate, thick, entirely cylindric, with rounded summit, strong, very finely, weakly striate high above, the rest smooth, yellowish white. 9½ nearly flat whorls, a little angular at the impressed suture, very slowly increasing, the last rounded below, above nearly horizontal (very little ascending). Aperture vertical, nearly semicircular, slightly narrowed below, with a very long and strong parietal lamella and two columellar lamellæ, the outer ends of which can be seen only in an oblique view. Peristome somewhat thickened, the margins not very unequal, joined by a thin callus, somewhat thickened near the outer insertion. Length 11, diam. 4 mm. Lebanon (*West.*).

P. doliolum var. *cedrorum* Westerlund, Fauna, 1 Supplement, 1890, p. 141.— [*Orcula orientalis* var.] "*cedretorum* Westerlund," Germain, Moll. terr. et fluv. de Syrie, i, 1921, p. 328.

10*b*. *Orcula s. coerulescens* (Naegele). Pl. 5, figs. 6, 7.

Differs from the type by the smaller length and generally bluish color. Sert, upper Mesopotamia (*Naegele*).

Pupa (*Orcula*) *orientalis* Parr. var. *coerulescens* Naegele, Nachrichtsbl. d. malak. Ges., vol. 42, Dec. 1910, p. 151.

A topotype figured measures, length 9.8, diam. 4.6 mm., with 9⅓ whorls, those of the upper cone very finely striate, buff, the later whorls slate-violet to purple-drab. The lip is white, very little expanded, somewhat thickened within. Parietal callus thickened close to the angle. Parietal lamella strong. Columellar lamella rather strong, not emerging; above it a lower, blunt supracolumellar. Internally the parietal lamella is high and strong; on the left side its crest is abruptly deflected outward, and a low oblong callous lump is developed on the parietal wall external to the lamella; beyond the deflection, within the ventral side, the parietal lamella becomes low. The columellar lamella is strong within the back, the supracolumellar much weaker. Both are rather robust.

11. Orcula robusta (Naegele).

Shell perforate, cylindric with obtusely conoid apex; whorls 10-11, a little convex, obsoletely obliquely striolate, the upper ones striate, glossy, corneous; the last whorl compressed towards the aperture, forming a crest around the umbilicus, with stronger striæ, ascending in front. Aperture angular at base; peristome broadly reflected, the columellar margin straight, outer margin arcuate, thickened in the upper part, the margins joined by an extremely strong callus. Deep within one columellar lamella; a parietal lamella joined to the callus and diminishing inwardly. Length 21 [error for 12?], diam. 4 mm. (*Naegele*).

Upper Euphrates: Balian-Keuy.

Pupa (*Orcula*) *robusta* Naegele, Nachrbl. d. m. Ges., vol. 38, Jan. 1906, p. 28.

This *Orcula* differs from its relatives especially by its sharp basal keel, the angular aperture and by the very heavy callous connection of the columellar and outer margins. The parietal lamella is united with the callus, but becomes weaker as it enters. The columellar lamella stands deep within on the upper part of the columella. In size this *Orcula* stands near *orientalis* Parr. (*Naegele*).

12. Orcula scyphus ('Friv.' Pfr.). Pl. 3, fig. 1.

Shell rimate, cylindric, striatulate, glossy, diaphanous, brownish-corneous. Spire terminating in a very short, rather acute cone. Whorls 11, rather flat, the last ascending in front, somewhat compressed at the base. Columella with one deeply-placed lamella. Aperture semioval, narrowed by one compressed parietal lamella. Peristome narrowly expanded, lipped, the right margin thickened tooth-like within. Length 9, diam. 3 mm., aperture 3 mm. long, 2⅓ wide (*Pfr.*).

Asia Minor: Brusa (Pfr., type loc.).

Pupa scyphus Frivaldsky on label, PFEIFFER, Zeitschr. f. Malak., 1848, p. 7; Monographia, ii, 326; iii, 540; iv, 667; vi, 305; viii, 368.—KUESTER, Conchyl. Cab., *Pupa,* p. 112, pl. 15, f. 10, 11. — WESTERLUND, Fauna, iii, p. 86. — MOUSSON, Journ. de Conchyl., xxii, 1874, p. 32.—REINHARDT, S.-B. Ges. naturf. Freunde Berlin, p. 17. — *Orcula doliolum* Brug. var. *scyphus* Pfr., BOETTGER, Nachrbl. d. m. Ges., xxvi, p. 3 (Cerigo); 1905, p. 106.

Pupa lindermeyeri 'Parreyss' PFEIFFER, Monogr., ii, 1848, p. 326, as synonym of *P. scyphus.*—*Pupa dormeyeri* SOWERBY, Conch. Icon., xx, 1878, pl. 20, f. 189.

Pfeiffer's description of *scyphus* indicates a far larger shell with more whorls than the specimens commonly known under that name in collections, judging by those received from Morelet, Jetschin, Coneménos and others. As no specimens agreeing with Pfeiffer's account are accessible and the internal structure is unknown, its relations to other forms of the region, including those here defined as subspecies, cannot be defined. The figures of Kuester, reproduced in our pl. 3, fig. 1, do not agree entirely with the original description, being smaller and showing two columellar lamellæ.

Whether any of the later references and localities pertain to the real *scyphus* cannot be affirmed at this time. The distribution of *scyphus* is therefore uncertain, and the records following undoubtedly were based upon several quite distinct forms.

Reinhardt, followed by Westerlund, regards *P. scyphus* as specifically distinct from *doliolum.* Boettger treated it as a variety of the latter. He has given the following localities for *scyphus,* but only an inspection of his collection would show what forms he included under this name: European side of the Dardanelles (v. Maltzan), Brussa (Andreae) and

Biledjik (Dr. K. Escherich); Smyrna (Krueper); Phineka, Elmali, Adalia (Conéménos) and Makri, in Lycia (Rolle); Bulghar-Dagh in Cilician Taurus (Naegele), Ordubad on the Araxes (Leder), and from Razoki near Urmia, Persia (Naegele). Other localities for *scyphus* are given by Germain (Moll. terr. et fluv. Syrie, 1921, p. 331) but we do not know what he understood that species to cover. He was in error in considering *turcica* a synonym of *scyphus.*

Pupa lindermeyeri Parr. was first published by Pfeiffer in the synonymy of *P. scyphus* (Monographia, ii, 326, 1848). This use of the name should prevent its restriction to the Syrian (Lebanon) form described by Mousson (Mittheil. naturforsch. Ges. Zürich, iii, no. 103, 1854, p. 395; also the rather perplexing notes in Journ. de Conchyl., 1874, p. 32).

12*a*. *O. scyphus* var. *heterostropha* Boettger. From the drift débris of the Sarus river at Adana, Cilicia, the three specimens found are sinistral. Length 7½, diam. 3½ mm. Two columellar lamellæ (*Boettger,* Nachrbl. d. m. Ges., vol. 37, 1905, p. 106).

12*b*. *Orcula scyphus palatalis* n. subsp. Pl. 3, figs. 5, 6.

There is fine, sharp striation on the convex whorls of the cone, the later whorls being less sharply striate, smooth in the middle; last whorl tapers downwards, having a flattened or slightly concave zone below the middle. The lip is somewhat expanded, with a moderate white thickening within. Parietal callus thin, weakly thickened at the right insertion. Parietal lamella strong, tapering in front, not emerging to the edge, penetrating inward one whorl, but the inner half-whorl is quite low and weak. One rather strong columellar lamella is visible in front, the weak trace of an upper one seen in oblique view in the mouth. Both are *very low and oblique on the axis within.* A low *lower-palatal fold* is seen deep in the mouth; it penetrates about one-third of a whorl inward, and corresponds to the external impressed zone mentioned above. Length 8.2, diam. 3.2 mm., 9½ whorls.

Sert, Kurdistan, received from O. Boettger as *O. d. mesopotamica* Mouss.

The long lower-palatal fold and the low, subequal spirals on the axis (seen by breaking into the whorl just above the aperture) are important features. Moreover, the shell is larger and the lip much less reflected than in *batumensis.*

O. moussoni is described as possessing a lower-palatal fold similar to that of *palatalis* but shorter, and the shell has a more robust figure.

12*c*. *Orcula scyphus crassa* n. n.

Differs from the type [of *doliolum*] by the thicker shell, the aperture contracted by a robust lip, peristome strongly dilated. Length 7, diam. 3 mm., 8-9 whorls. Balien-Keuy, on the upper Euphrates [*Pupa* (*Orcula*) *doliolum* var. *incrassata* NAEGELE, Nachbl. d. m. Ges., vol. 38, 1906, p. 28, not *Pupa incrassata* Sowb.].

Without knowledge of the form of the lamellæ within the last whorl, and the presence or absence of an internal palatal fold, it is quite impossible to tell the rank or position of this form, which appears to differ from *mesopotamica* by the thicker shell and lip.

12*d*. *Orcula scyphus batumensis* (Ret.). Pl. 3, figs. 7-10.

Very conspicuously different from the parent form [*doliolum*] by the strong cervical ring and extraordinary development of the callus. I collected this new variety in the debris of the Tschorok at Batum (Caucasus). They belong to two forms, one having 9-10 whorls with weakly raised riblets and two distinctly visible columellar lamellæ in the aperture; length 6.5 to 8.9 mm., diam. 2.5 to 3 mm. The second form is narrower, has 9-10 nearly smooth whorls, and the two columellar lamellæ recede so far that they are hardly visible in the mouth. Length 5.25 to 7, diam. 1.9 to 2 mm. Such slender examples of *doliolum* as the second form are hitherto scarcely known. A separation of the two forms seems to me impossible, as transitions occur which could be referred to one as well as the other (*Ret.*).

Pupa (*Orcula*) *doliolum* var. *batumensis* RETOWSKI, Bericht Senckenb. Ges., 1888-9, p. 254. — STURANY, Ann. k. k. Naturhist. Hofmus., Wien, xx, p. 304, fig. 7.

The more slender form described by Retowski may be considered typical of the subspecies. Sturany has noted it from Siehe, in Bulghar-Dagh, and Karagöl, Bulghar-Maaden, at 1500 to 1600 meters, in the Erdsahias-Dagh, Asia Minor. He figured long and short examples: 4.4 x 2 to 6.5 x 2.3 mm. are given as extremes, whorls from 7½ to 9.

The specimens from Siwas, Tokat Vilayet, drawn in our plate, measure up to 6.3 mm. long, 2.2 wide, with 8½ whorls. They are brown, with a wide opaque white tract behind the peristome, and a crest, weak to strong, as shown in the profile view. The last whorl is somewhat flattened and tapering to the base. Spaced cuticular riblets such as typical *doliolum* has, are wanting. The lip is rather broadly reflected. A distinct angular tubercle united with the lip-insertion. The parietal lamella is remote from the edge of the callus and quite low as seen in the mouth; deep within, on the left side, it becomes very high. The columellar lamella becomes very strong within the left side, where also the supracolumellar is represented by a smaller lamella, not connected with the very weak one on the columella. These lamellæ are exactly as in *O. mesopotamica*. There is a quite short lower-palatal fold within the left side (fig. 10, *p.*), visible externally as a light spot immediately to the left of the aperture, above the umbilical crevice.

A smaller form of Asia Minor may be attached to *batumensis* as var. *enteroplax*, n. v., the type from Brussa (pl. 3, figs. 11-13). The internal structure is as described for *batumensis*, the parietal lamella being low in front, very large within. Columellar lamella prominent in a front view, where no supracolumella is visible. Palatal fold short, lateral. Exterior brown, white behind the lip, finely striate, without the spaced riblets of *doliolum*. Terminal cone is very short. Lip is rather heavily calloused. Length 5.1, diam. 2.1 mm.; 8 whorls.

A form from Amasia is similar except that the columellar lamella does not emerge, and is visible in an oblique view in the mouth only as a blunt prominence or angulation. Internal structure as in *enteroplax*. Length 5.4, diam. 2.1 mm.;

8 whorls. It was labeled *O. doliolum* var. *critica* by Dr. Boettger, but probably is scarcely separable from *enteroplax*.

12*e*. *Orcula scyphus græcus* n. subsp. Pl. 3, figs. 2, 3, 4.

The shell is cylindric with short terminal cone, brown, the upper third finely, sharply striate, lower whorls obsoletely so; last whorl ascending in front, hardly compressed though somewhat tapering towards the base, paler brown behind the lip. Peristome thin, reflected, but little thickened within. An angular nodule on the rather thin parietal callus. Parietal lamella high, tapering forward and emerging to the edge of the parietal callus. Within it is high and flaring. Two folds emerge on the columella, either weakly, distinct only in an oblique view, or distinctly in front view. They strengthen within, the lower one being somewhat the stronger within the back; but the upper is continuous to the columella, not interrupted as in *batumensis*. There is no trace of an internal palatal fold.

Length 6.7, diam. 2.4 mm.; 9 whorls.
Length 6.4, diam. 2.3 mm.; 9 whorls. Type.
Length 5.5, diam. 2.3 mm.; 8¼ whorls.

Greece: Chalcis, Eubœa (Conéménos).

This form differs from *batumensis* by lacking an internal palatal fold, by the parietal lamella being high in front and emergent, and by the smaller development of the columellar lamella within the back of the last whorl, the two lamellæ being nearly equal there. The peristome also is less developed, with only quite moderate internal thickening, consequently there is no such conspicuous white or buff tract behind it as in the Asiatic form, and no crest there.

13. ORCULA MOUSSONI (Reinh.).

Reinhardt separated from *orientalis* the form of Aleppo, received from Mousson, as *Pupa moussoni*, characterized as follows: Shell cylindric or ovate-cylindric, terminating in a short, obtuse cone; solid; pale corneous, flexuosely rimate. Whorls 9½ to 10, the first five increasing in width rapidly, but little in height, convex, costulate, separated by a deep suture; the remaining whorls slowly increasing, nearly equal, flattened, glossy, obliquely striate, joined by a whitish, little-impressed suture; the last whorl two-fifths the total length; not tapering, ascending a little to the aperture. Aperture semicircular, rounded basally, the peristome expanded, strongly white-lipped within, the margins distant and joined by a strong callus tuberculate at the insertions; right margin thickened in the middle, columellar margin broadly spreading. Parietal wall bearing a strong whitish and deeply entering lamella which does not reach to the callus. Columella having two deep, diverging folds. Length 10 to 10.5, diam. 4.5 mm.; aperture 3 mm. long and wide (*Reinhardt*).

Syria: Aleppo (Haleb).

Pupa moussoni REINHARDT, Sitzungsber. Ges. naturforsch. Freunde, Berlin, 1880, p. 44.

Distinguished from *orientalis* by the somewhat smaller size, cylindric shell with bluntly conic summit, by the semicircular aperture with broad lip, and by the strong, tubercularly thickened parietal callus. Another character peculiar to this species, lacking in all other species of *Orcula* except *O. scyphus*, is the internal ridge-like thickening in the last whorl, about 2 mm. long, running parallel to the suture, and visible externally as a white line above the umbilical crevice to the left of the columellar margin (*Reinhardt*).

Series of O. raymondi (*Pilorcula* Germain).

Rimate and minutely perforate Orculas, in which the parietal and columellar lamellæ are enormously widened within the last whorl; in fresh specimens there is a series of spines or points on the epidermal riblets at the upper third of each whorl, or present only on the upper whorls (only weakly developed or wanting in most apparently fresh adult specimens). Northern Syria, Asia Minor to Russian Armenia and Transcaucasia.

The typical *O. raymondi* is known by the original account only. The Caucasian forms show considerable variation in size and the development of columellar lamellæ. As in other Orculas, only the columellar and supracolumellar enter deeply, others when present being short and confined to the columellar lip-expansion. Boettger and Retowski, who handled more of the Caucasian forms than any other writers, consider all to be forms of *raymondi.* As the material at hand comprises only various forms of *trifilaris* and *bifilaris,* and not the typical *raymondi,* I am unable to review the question of specific identity of the Caucasian forms with *raymondi.* All of the references are given under the latter.

Small, length 2.5, diam. 1.5 mm.; bristles well developed; three thread-like lamellæ on columella; Beyrout. *O. raymondi.*
Larger, diam. about 2 mm. or more. Caucasus, etc.
  4 lamellæ on columella. *O. r. trifilaris f. quadrifilaris.*
  3 lamellæ on columella.
    Supracolumellar, columellar and infracolumellar. *O. r. trifilaris.*
    A short lamella between columellar and supracolumellar. *O. r. bifilaris f. intermedia.*
  2 lamellæ on columella. *O. r. bifilaris.*

14. Orcula raymondi (Bgt.). Pl. 4, fig. 1.

The shell is small, perforate, cylindric, of a tawny-corneous tint, ornamented with small, oblique, whitish, symmetric raised epidermal laminæ which are prolonged in the upper part of the whorls in stiff, acute, lengthened and ascending points. The epidermal laminæ, very closely placed on the earlier whorls, become more and more spaced as they approach the aperture. Spire extremely obtuse, the summit smooth and paler. Seven quite convex whorls, slowly, regularly increasing, and separated by a strongly impressed suture. The first whorls are subangular as though keeled, where the epidermal laminæ are produced in form of acute darts; the carina disappears on the fourth whorl. The last whorl is rounded, a little oblong, and markedly ascending towards the aperture. Aperture slightly oblique, oblong, whitish within and provided with 4 lamellæ: the first [parietal lamella] strong, compressed and elevated on the convexity of the penult whorl, which it follows inward. The three others are small, very long, and on the upper part of the columella. Peristome lightly expanded throughout, with a weak white thickening within, the margins joined by a thick callus colored like the lip. Length 2.5, diam. 1.5 mm. (*Bgt.*).

Syria: under dead leaves and stones in an oak forest on a mountain the base of which is washed by the river of Beyrout, 6 kilom. from its mouth (Capt. Léon Raymond, 1860).

Pupa raymondi BOURGUIGNAT, Revue et Mag. de Zoologie (2), xv, 1863, p. 259, pl. 19, f. 10-13; reprinted in Moll. nouv., litig. etc., ii, p. 48, pl. 6, f. 10-13.—PFR., Monogr., vi, 306.—*Orcula raymondi* Bgt., KOBELT, Rossm. Iconogr. n. F., viii, p. 75, pl. 232, f. 1497 (from Bgt.).—*Orcula* (*Pilorcula*) *raymondi* Bourguignat, GERMAIN, Voy. Kerville: Moll. terr. et fluv. de Syrie, 1921, p. 328, figs. 27-29 (after Bgt.).

Pupa trifilaris MOUSSON, Coq. terr. et fluv. recueillies dans l'orient par M. le Dr. Alexandre Schlaefli, ii, 1863, p. 71; reprint from Vierteljahrsschrift der Naturforsch. Ges. in Zürich, viii, 1863, p. 391.—REINHARDT, Sitzungsber. Ges. naturf. Freunde Berlin, 1880, p. 15 (Transcaucasia at Redutkale, Lailasch, Suram, Katerinenfeld).—*Pupa* (*Orcula*) *trifilaris* Mouss., BOETTGER, Jahrb. d. m. Ges., vi, 1876, p. 404 (Lailasch, Kreis Letschghum, Caucasus).—*Pupa* (*Orcula*) *raymondi* Bgt., BOETTGER, Jahrb. d. m. Ges., viii, 1881, p. 229 (Kutais, varies up to 11 whorls, of a reddish-brown color, 5 x 2 mm. Also Gordi on the Tsheni-Tshali).—*Pupa* (*Sphyradium*) *bifilaris* MOUSSON, Journ. de Conchyl., xxi, 1873, p. 210, pl. 8, f. 8 (Forest of Gorktscha); xxiv, 1876, p. 142 (valley of the Akstafa, Transcaucasia, Sievers; the upper columellar lamella almost wholly effaced).—*Orcula bifilaris* Mouss., KOBELT, Iconographie n. F., viii, 1899, p. 76, pl. 232, f. 1498.—*Orcula raymondi* (Bgt.) var. *trifilaris* Mouss. und var. *bifilaris* Mouss., BOETTGER, Bericht Senckenb. Naturforsch. Ges., 1889, p. 23 (*trifilaris* from Wäldern der Niederung Kurdschips u. auf dem Berge Guk; *bifilaris* in the S.-E. and N. foothills of the Oschten-Fischt group); Nachrbl. d. m. Ges., 1905, p. 108 (drift of the Sarus, Adana, Cilicia, specimen with 2 columellar folds).—*Pupa* (*Orcula*) *raymondi*

Bourg. var. *bifilaris* Mouss. f. *longior* et f. *intermedia* RETOWSKI, Bericht Senckenb. Nat. Ges., 1889, p. 254.—*Pupa raymondi* Mss. var. *bifilaris* Mss., *trifilaris* Mss. und *quadrifilaris* forma nova, ROSEN, Nachrbl. d. m. Ges., vol. 37, 1905, p. 57; also *Pupa raymondi* B. f. *bifilaris; bifilaris truncata,* pl. 2, f. 3; *trifilaris* Mouss.; and *Pupa raymondi* B. f. *quadrifilaris truncata,* pl. 1, figs. 9*a-b*, ROSEN, Annuaire Mus. Zool. l'Acad. Imp. St.-Pétersb., xvi, 1911, p. 120.

The small size of the shell (2.5 x 1.5 mm.) and the remarkable development of epidermal spines even on the later whorls, distinguish typical *raymondi* from the Caucasian forms. The spines in Bourguignat's figure (which is copied photographically on my plate) look almost too good to be true; they were probably restored somewhat by the artist. Kobelt, Germain and Boettger appear to know this typical *raymondi* only by the original account; and so far as I know, none have been collected at Beyrout since the original lot. The internal structure is not known.

14*a*. *Orcula raymondi trifilaris* (Mouss.). Pl. 4, figs. 2, 3, 4, 5, 6.

Shell rimate-perforate, ovate-cylindric, closely coiled, slightly striatulate, slightly shining, corneous. Spire with very obtuse summit and well-marked suture. Eight whorls, of which four form the summit, the rest convex, tapering from the fifth, the last whorl more tapering, a little compressed, somewhat ascending. Aperture vertical, small, ovate-semicircular; on the parietal wall one strong and compressed lamella. Peristome expanding a little, acute, white-lipped within, the margins subparallel, the right margin arcuate, columellar margin produced, straight, the columellar area with three minute folds, diverging backward. Length 4½, diam. 2 mm. (*Mouss.*).

Transcaucasia: Reduktaleh (Dr. Schlaefli, type loc.).

This form is at least subspecifically distinct from *raymondi* by its larger size and probably also by the less developed bristles.

Boettger (1876) found that in fresh specimens from Lailasch on each of the distant raised growth-riblets a long, erect bristle stands at the upper third, so that the crown of hairs stands near the suture, and not, as in *O. doliolum,* at the lower edge of the whorls. Reinhardt (1880) made the same observation on specimens from the Caucasus, which show somewhat whitish epidermal riblets which are rather distant on the upper whorls, and produced in a rather long hair-like spine on the upper part. The last whorl may have even two rows of spines. In most specimens in collections these spines are very slightly developed or are entirely rubbed off.

Internal structure (pl. 4, figs. 2, 5).—The parietal lamella becomes a little lower as it enters. Within the left side it begins to enlarge, and the edge *flares outward.* On the ventral side it attains maximum size, and on the right side the flare disappears and the lamella diminishes rapidly; its total length is about 1½ whorls. The columellar lamella becomes very wide within, nearly meeting the enlarged parietal lamella on the ventral side; after that diminishing to the size of the supracolumellar lamella, which is nowhere enlarged. The infracolumellar lamella is short, near the aperture only. Specimens from Suran measure:

Length 4.5, diam. 2 mm.; 9 whorls. Fig. 4.
Length 3.8, diam. 2 mm.; 8 whorls. Fig. 6.

Form *quadrifilaris* Rosen. Pl. 4, fig. 7. Having a fourth columellar fold below the three characteristic of *trifilaris.* The most conspicuous difference making it easily known from all the other forms is the quite flat summit of the shell, which appears as though truncate. The shell of 4.2 mm. long has 7½ whorls, of which the first 3½ form a flat surface with scarcely projecting apex. Drift of the Psekup, Caucasus; 2 found among 14 *bifilaris* (*Rosen*).

In his paper of 1911 Rosen states that he has recently found equally truncate *bifilaris* Mouss., and Dr. Wagner informed him that in typical *raymondi* of Asia Minor the truncate spire also occurs. He has named the form *bifilaris truncata,* and figured a specimen from flotsam of the Psekup (see pl. 4, fig. 8). Rosen also figures what he calls *P. raymondi* f. *quadrifilaris truncata,* copied in our pl. 4, fig. 7. This is exactly what he formerly called *quadrifilaris,* from the same place.

14*b*. *Orcula raymondi bifilaris* (Mouss). Pl. 4, fig. 9.

Shell small, closely rimate, ovate-cylindric; smoothish, ornamented with widely-spaced and fugacious membranous laminæ, rufous-corneous. Spire closely coiled, more rapidly decreasing above, the summit obtuse; suture somewhat impressed. Whorls 8, the first convex, following ones rather flattened; the last whorl slowly ascending a little, rounded, rather swollen beneath. Aperture subvertical (12° with the axis), semicircular. Peristome white, reflected, lipped within, the margins remote, parietal wall having a regular parietal lamella; right margin somewhat sinuated below the insertion, then a little thickened and bent forward; columellar margin broadly spreading, with two revolving threads, the upper minute, immersed, the lower larger. Length 4.1, diam. 2.3 mm. (*Mouss.*).

Transcaucasia.

O. bifilaris was at one time thought to be merely a form of *doliolum* (Reinhardt, Jahrb. d. m. Ges., iv, 1877, p. 76, and Boettger, vi, 1879, p. 31; also p. 404), but Boettger subsequently relinquished this opinion, and considered it a variety of *O. raymondi.* The lamellæ of *bifilaris* are somewhat less broadly developed within the last whorl than in *trifilaris;* there is more space between the parietal and the columellar. The specimen figured from the Oschten-Fischt range, measures, length 4.1, diam. 2 mm.; fully 8 whorls.

O. raymondi bifilaris form *longior* (Ret.). Differs from the typical form of *bifilaris*, found by me in various places in the Caucasus, by its significant size, larger aperture, more produced apex as well as the more twisted columella. It stands in the same relation to *bifilaris* as *trifilaris* Mouss. to *raymondi* Bgt. Length 4.9 to 5.7, diam. 2 to 2.25 mm. Samsun (*Retowski,* 1889).

A conspicuously truncate form from the drift of the Psekup has been named *P. bifilaris truncata* Rosen (pl. 4, fig. 8).

O. raymondi bifilaris f. *intermedia* (Ret.). Whorls 9; peristome connected. Columella with three folds, a short third one further out placed between the usual two. Length 6, diam. 2⅔ mm. By the presence of the short third fold this form makes a transition to *P. raymondi*, which has three columellar folds of equal strength. One specimen. Sudak, Crimea, on the strand. [*Pupa* (*Orcula*) *doliolum* var. *intermedia* Retowski, Malak. Blätter, n. F., vi, 1883, p. 59.]

Retowski supposed that this, together with specimens having two columellar folds, and many other species of land shells, floated from Transcaucasia or Asia Minor, as they were not found by him anywhere inland in the Crimea.

Originally described as a form of *O. doliolum*, Retowski subsequently (1889) regarded it as an intermediate link between *bifilaris* and *trifilaris* (an erroneous opinion). Of two specimens found at Samsun, one had only a weak, short middle fold near the peristome, but in the other this fold is as long as the other two, but is notably weaker, while in *raymondi* and *trifilaris* the middle fold is the strongest [being the columellar lamella proper].

Genus LAURIA Gray.

Cochlodon Lowe, Trans. Cambr. Philos. Soc., iv, 1831, p. 62 (emendation of *Cochlodonta* Fér., a subgenus of Helix); first species, here designated type, *Helix C. anconostoma*.

Lauria Gray, in Turton's Manual of the Land and Freshwater Shells of the British Islands, new edit., revised by J. E. Gray, 1840, p. 193, for *P. umbilicata* and *P. anglica;* P. Z. S., 1847, p. 176, type *Pupa umbilicata.* — Herrmannsen, Indicis Gen. Mal., i, May 25, 1847, p. 578, type: *Pupa umbilicata* Drap.

Eruca Swainson, Malacology, 1840, p. 334, no type selected. —Herrmannsen, Indices Gen. Malac., i, p. 428, type: *Pupa umbilicata* Drap.

Gastrodon Lowe, Ann. Mag. N. H., Apr. 1852, p. 275, for *Pupa fanalensis* only; P. Z. S., 1854 (1855), p. 207, "type *P. umbilicata* Drap." Not *Gastrodon* Raf., 1815.

Reinhardtia Boettger, Jahrb. D. malak Ges., vi, 1879, pp. 29, 403 (restricted to group of *P. cylindracea* DaC.). *P. cylindracea* is here designated type.

The shell is perforate and rimate or umbilicate, ovate, oblong-conic or cylindric, having a deeply penetrating angular lamella (rarely wanting) and often other teeth, the immature (neanic) stage with lamellæ on the parietal wall and columella and short radial laminæ at intervals within the basal wall. Embryonic shell usually very finely striate spirally. Type *L. cylindracea.*

Distribution: Palæarctic and Ethiopian regions.

Orcula resembles this genus by having spiral lamellæ in the young, but it differs by lacking radial basal laminæ. In the adult stage the angular lamella of *Orcula,* when present, is tubercular, not lamellar and entering, as in *Lauria.*

Lauria comprises two subordinate groups, rather distinct in the apertural teeth, but even more by the reproduction, *Lauria* proper being viviparous, while the subgenus *Leiostyla* is oviparous. Perhaps these groups should be ranked as distinct genera; but they are identical in the peculiar armature of the young shells.

Tertiary Species of Lauria.

No species of the typical group of *Lauria* are as yet known from the Tertiary. It is doubtless a derivative of the more fully toothed group *Leiostyla,* and probably an old branch which may turn up in the Eocene. Its discontinuous, far-flung distribution certainly denotes a considerable antiquity. Probably we will eventually learn that *Lauria* (*Leiostyla*) was present in the Paleocene; the Neocene and Recent species are to be viewed as scattered survivors of an old genus. The extravagant development of teeth and apertural calluses, seen in many species, is an expression of racial old age.

The following list, contributed by Dr. W. Wenz, of the Senckenbergische Museum, Frankfurt, contains only species of *Leiostyla:*

LAURIA PRISCILLA (Paladilhe). *Vertigo priscilla* Paladilhe, Rev. Sci. Nat., ii, 1873, p. 53, pl. 2, figs. 22-24.—*Vertigo (Ptychalæa) priscilla,* this work, vol. xxv, p. 220. Middle Pliocene, Plaisancien: Celleneuve near Montpellier, France.

LAURIA AUSTRIACA Wenz. Senckbergiana, iii, 1921, p. 28, fig. 2. Lower Pliocene, Pontien: Congeria beds, Leobersdorf, Lower Austria.

LAURIA GOTTSCHICKI Wenz. Archiv für Molluskenk., 1922, p. 107, figs. Upper Miocene, Sarmatien: Steinheim am Albuch, Württemberg.

LAURIA MINAX Boettger. Jahrb. Nassau. Ver. f. Naturk., Wiesbaden, xlii, p. 237, 319, pl. 6, f. 2. Upper Oligocene, Chattien: Landschneckenkalk, Hochheim. *L. minax microdoma* Bttg., *l. c.*, is merely a deformed specimen.

Key to Subgenera and Sections of Lauria.

- a^1. Aperture having only angular and columellar lamellæ in the adult stage, the columellar often immersed or obsolete, or rarely both are wanting.
  - b^1. Shell unicolored, only weakly striate. Subgenus LAURIA proper, p. 45.
  - b^2. Shell banded or bicolored, distinctly striate. Subgenus PETRARCA, no. 51. p 122
- a^2. Angular, parietal, columellar and palatal teeth present. Subgenus LEIOSTYLA, species 15-55. [illegible]
  - b^1. Parietal lamella higher (i. e., projecting into the mouth further) than the angular. Section *Wollastonula.* p 114
  - b^2. Parietal lamella not higher than the angular, generally lower.
    - c^1. Parietal lamella emerging about as far as the angular; numerous teeth, all emerging to peristoma. Section *Scarabella.* p 88
    - c^2. Parietal lamella not emerging so far as the angular.
      - d^1. Diameter about two-thirds of the length; whorls not more than 5½, with lamellar ribs; parietal lamella minute or wanting. Section *Mastula.* p 116 (spp.
      - d^2. Diameter relatively less, or whorls more numerous. Section *Leiostyla* s. str.

Keys to species may be found under *Lauria* and *Leiostyla,* the latter following species no. 14. (p.68)

Subgenus LAURIA proper.

Shell perforate and deeply rimate, cylindric-tapering to ovate, smoothish or finely striate, the aperture having a small angular lamella continued inward as a short or long thread, and a very small columellar lamella, sometimes not reaching to the columella. No palatal folds.

Viviparous.

Distribution: Europe, the Atlantic Islands, Africa, Island of Bourbon.

This group of L. cylindracea is remarkable for its conservatism in characters and the wide distribution. Its presence in the Azores, St. Helena and Jamaica is apparently traceable to importation by commerce; but there are species apparently endemic in places as remote as Madeira, the Canaries, South Africa and Bourbon. None of these vary much from the genotype.

A few forms are toothless, such as *L. sempronii dilucida*, and mutations of some forms which normally are toothed.

Specimens of all of the species except *L. vulcanica*, *L. fagoti* and *L. desiderata* are in the collection of the Academy, most of them in considerable series.

Key to species of Lauria proper.

1 Palæarctic species, Europe, Atlantic Islands, northern Africa (2)
Ethiopian species, Abyssinia to the Cape; Bourbon (10)

2 Larger species, the diam. (above aperture) 1.5 to 2 mm.; base distinctly compressed and subangular (3)
Smaller species, thin, diam. 1.2 to 1.6 mm.; base rounded or but little compressed (4)

3 Umbilicus funnel-shaped, bounded by a strong basal keel. *L. umbilicus*, no. 2
Umbilicus moderate, basal keel less pronounced. *L. cylindracea*, no. 1

4 Aperture without teeth of any kind. *L. sempronii dilucida*, no. 4*a*
An angular lamella present (5)

5 A low columellar lamella, sometimes nearly immersed (6)
No columellar lamella in the adult stage (8)

6 Finely, sharply striate; generally banded, or brownish above the periphery. Azores. *L. fasciolata*, no. 51
Smoothish or obsoletely striatulate, of uniform, pale tint (7)

7 Spain. *L. fagoti*, no. 5
Madeira, Canaries. *L. fanalensis*, no. 7

8 Ovate, most minutely striate, silky; Sardinia. *L. vulcanica*, no. 3
Cylindric-ovate, weakly striatulate (9)

9 Thread inward from the angular lamella very weak; Europe. *L. sempronii*, no. 4
Thread well developed; Caucasus. *L. caspia*, no. 6

10 Abyssinia. *L. bruguierei*, no. 8
Mt. Kenia, British East Africa. *L. desiderata*, no. 9
Island of Bourbon. *L. bourbonensis*, no. 10
South Africa (11)

11 Angular lamella long, curving into the interior (12)
Angular lamella short; lip rather wide; base pinched out in a short blunt keel behind the basal lip. *L. tabularis*, no. 14

12 Base subangular; length 3.4 to 4.24 mm. *L. farquhari*, no. 11
Base narrowly rounded; length 3 to 3.5 mm. (13)

13 Radial basal laminæ large in the early neanic stage, persisting smaller nearly to the adult stage. *L. cryptoplax*, no. 13
Radial basal laminæ very small, present only in the early neanic stage. *L. dadion*, no. 12

1. Lauria cylindrica (Da Costa). Pl. 6, figs. 1 to 8.

The shell is perforate and shortly rimate, cylindroid, tapering slowly upward, or ovate, the summit rounded, obtuse; semitransparent-cinnamon, glossy, scarcely striate. The whorls are moderately convex, the last ascending somewhat in front, compressed at base, forming a blunt basal keel. The truncate-oval aperture is slightly oblique, the peristome reflected, white or creamy, flattened on the face, with a heavy callous thickening towards and at the inner margin. The short, curved angular lamella connects with the outer lip, and is continued inward as a thread about a half whorl long, more or less. A very low, thread-like columellar lamella is weakly developed, but often lacking.

Length 3.5, diam. 1.8 mm.; 6½ whorls. Tadcaster.
Length 2.8, diam. 1.7 mm.; 5½ whorls. Tadcaster.
Length 4.5, diam. 2 mm.; 7 whorls. Calvados.
Length 3.2, diam. 1.6 mm.; 6 whorls. Calvados.

Europe, especially in coastal countries, east to the Caucasus; Transcaucasia; Algeria; varieties introduced in the Atlantic islands.

Turbo cylindraceus DaCosta, Hist. Nat. Testac. Brit., 1778, p. 89.

Pupa cylindracea Paulucci, Bull. Soc. Malac. Ital., vii, 1881, p. 120; viii, 1882, p. 278 (Sardinia); with var. *misella*, p. 279, pl. 8, f. 2.—Westerlund, Fauna, iii, p. 80, with var. *montigena* and *inæqualis*.

Charadrobia cylindracea (DaCosta) Boettger, Jahrb. D. m. Ges., xiii, 1886, p. 148 (Transcaucasia, at Helenendorf, Derbent, Kusary, Schach-Dagh).

Lauria cylindracea DaC., Kobelt, Iconogr. n. F., viii, p. 72, figs. 1490-3, with var. *misella*, *anconostoma*, *villæ* and *umbilicus*.—Kennard & Woodward, Proc. Geol. Asso., vol. 28, pt. 3, 1917 (Postpliocene, Ireland).

Pupa umbilicata Drap., Tabl., 1801, p. 58; Hist., p. 62, pl. 3, f. 39, 40..—Pfeiffer, Monogr., ii, 329; iii, 542; viii, 370 (see for older references).—Gray in Turton, Manual, 1840, p. 193, with var. *edentula*, p. 194.—Jeffreys, Brit. Conch., i, p. 246. —Bourguignat, Malac. d'Algerie, ii, 1864, p. 91, pl. 6, f. 8-11, 13, 14, with, p. 92, var. *subperforata* and *bidentata*.—Westerlund, Fauna, iii, p. 80.—Mousson, Jahrb. d. m. Ges., i, p. 95 (Ued Ksib near Mogador).—Reinhardt, Jahrb., iv, 1877, p. 283, immature stage.—Boycott, Proc. Malac. Soc. London, xiv, p. 171.

Pupa umbilicata var. ? *blakei* Shuttl., v. Martens, Die Heliceen, 1860, p. 290, name only (Ireland).

Bulimus unidentatus Vallot, 1801, according to Westerlund.

Pupilla drapernaudii Leach, in Turton, Manual, 1831, p. 98; Syn. Moll. Gt. Brit., 1852, p. 91.—*Helix bocconiana*

BENOIT, Ill. Test. sist., crit., iconogr., Test. estramar. Sicilia ult., 1857, p. 144, pl. 4, f. 7; cf. REINHARDT, Jahrb. d. m. Ges., 1877, p. 283.—? *Pupa concolor* Zgl., MENKE, Syn. Meth. Moll. in Mus. Menkeano, 1828, p. 18, name only, but with query whether it may be a toothless *P. umbilicata* Dr.

This abundant species is readily known by the small angular lamella, continued inward thread-like, the thickened, reflected lip and tapering-cylindroid form. According to Boycott it occurs chiefly about ivy-covered stone walls, ledges with grass and leaves in limestone quarries, also on trees and among stones and rubbish. These conditions being commonly found in cultivated districts, it has been accidentally carried about with plants etc., thus reaching such remote spots as St. Helena, Jamaica and other islands.

In many museum lots there are short specimens such as fig. 2, together with the longer ones. Westerlund has called these form *curta*. Exactly the same dimorphism is seen in *anconostoma,* where the smaller form has been called *curta* Lowe.

In Transcaucasia, Boettger notes that at Helenendorf there is no columellar lamella; the lip is broadly reflected, flat, white or with a brownish cast. L. 3¾, d. 2¼ mm. Similar but smaller ones from Derbent, where it is common, 3⅛ x 2 mm. In Kusary the umbilicus is broader with sharper keel, a transition to var. umbilicus Roth; abundant; 3½ x 2 mm. Those from Schach-Dagh are similar. At Mamudly and Zalka (Jahrb., vi, 30) the specimens are like small English ones.

Named varieties and mutations follow, the original descriptions being quoted.

Form *edentula* Gray. Mouth without teeth; England. This apparently includes form *inermis* West. (Fauna Europæa, 1876, p. 184. Aperture entirely toothless. Visby, Sweden.

Mut. *edentula* Jeffreys (Brit. Conch., i, 1862, p. 247). Columellar tooth wanting. Name preoccupied by Gray, 1840.

Mut. *alba* Jeffr., *l. c.* Shell white or colorless. A specimen from Grange-over-Sands, Lancashire (G. C. Spence), is figured, pl. 6, fig. 3. It has also been referred to as *P. umbilicata* var. *albina* (Ashford, J. of Conch., iv, 312, and by various continental authors).

Form *gracilis* Issel. Smaller, more elongate than the type, and less tapering at summit. 3¼ x 1½ mm. Botanical garden of Pisa. (*Pupa umbilicata* var. *gracilis* Issel, Mem. Soc. Ital. di Sci. Nat., ii, Milano, 1866, p. 22.)

Form *subperforata* Bgt. Differs from typical *cylindracea* by the slightly narrower umbilical perforation, and the nearly rounded instead of compressed base. Bou-Mecid, near Constantine, Algeria (Bgt., Malac. Alg., ii, 92). Bourguignat's var. *bidentata* is the typical *cylindracea*, having a small columellar lamella.

Var. *montigena* Westerl., 1884. Smaller, blackish, ventricose, with short, rounded spire, columella with an emerging fold and deep within a conical tooth. 3 x 2 mm. Skaralid, in Skane, Sweden (*Westerl.*).

Var. *inæqualis* Westerlund, 1887. Ovate-cylindric, reddish-corneous; whorls 6, convex, the third from the last much (often nearly doubly) lower than the penult, this being only one-third shorter than the last, which is ventricose behind. Peristome narrow, reddish, outer margin not curved, simple. Parietal lamella hardly thickened above, separated from the outer lip, with an adjacent tooth. Columellar lamella emerging far upon the middle of the columella. 3⅔ x 2 mm. Greece (*Westerlund,* Fauna, iii, 80).

L. c. villæ ('Charp.' Kuester). Pl. 6, fig. 9. Differing from *cylindracea* "by the greater size, cylindric shape, wider umbilical cavity (though narrowly perforate), more distinct striation and the relatively longer aperture; especially also by the absence of a columellar fold. Length 2, diam. ⅖ lines; 6 whorls." Neighborhood of Brienz on Lake Pusano, Switzerland (*Pupa villæ* Charpentier, Kuester, Syst. Conch. Cab., *Pupa,* 1849, p. 107, pl. 14, f. 32, 33).

Kuester's figure, reproduced in fig. 9, looks like *anconostoma.* Specimens from Milan and Florence received as *villæ,* appear to be *anconostoma.* The lip is narrow, and there is no columellar lamella in the adult stage; size a little smaller than given by Kuester, 3.2 x 1.6 mm. The young have three basal laminæ at 90° intervals, thus a trifle more widely spaced than in *anconostoma.*

L. c. sabaudina (Locard). Shape of *sempronii;* 7 slightly convex whorls; aperture bidentate; 1 fold above touching the end of the outer lip; 1 little fold on the middle of the columella; peristome interrupted, expanded, reflected, thick and sharp. Shell thin, glossy, corneous or greenish, ornamented with fine, very close, half-effaced striæ. Length 3½ to 4, diam. 1¾ mm. Aix-les-Bains, Chambéry (Savoie). *Pupilla sabau-*

dina LOCARD, Ann. Soc. Agric. Lyon (7), iii, 1895 (1896), p. 216.

This appears to be intermediate between *L. cylindracea* and *sempronii,* having the color and sculpture of the latter, but the size and columellar lamella of *cylindracea.* It has not been figured, and is known by Locard's account only.

The description of variety *L. umbilicata margieri,* Bull. Soc. Corse, xxii, 1903, p. 278, is not accessible to me.

Lauria c. poupillieri (Bgt). Pl. 6, figs. 16, 17, 18.

Shell subperforate and *curved-rimate,* obesely subcylindric, thin, very glossy, subpellucid, corneous, smoothish, very sharply striatulate under a lens. Spire obese, not very high, the apex obtuse. Whorls 7, slightly convex, slowly increasing, separated by a moderately impressed suture, the last slightly larger, gibbous and compressed at base, at the aperture a little contracted and *strongly ascending in front.* Aperture slightly oblique, semiovate, tuberculously thickened at the insertion of outer lip, and with a minute spirally entering lamella. Columella straight. Peristome whitish-thickened, flat, a little expanded and reflected, the outer margin angularly bent, margins approaching. Alt. 4, diam. 2 mm. (*Bgt.*).

Algeria: drift of the ravine of Chabet-Beinan near Cape Caxine, about 14 kilom. west of Algiers.

Pupa poupillieri BOURGUIGNAT, Malac. d'Algerie, ii, 1864, p. 89, pl. 6, f. 4-7.

By its widely open umbilical region it somewhat approaches *L. umbilicus* Roth. Not seen by the author.

Lauria cylindracea anconostoma (Lowe). Pl. 6, figs. 10, 11, 12.

Lip decidedly *narrower* than in *cylindracea;* angular lamella less thick, generally *not connected with the outer lip-insertion.* Length 3 mm. (fig. 11) to 4.3 mm. (fig. 10).

Madeira (type loc.), in the low and intermediate zones, abounding about walls and cultivated grounds, seldom ascending higher than 2500 ft.; also on the Desertas. Canaries: Fuerteventura, Teneriffe, Hierro, in the zone of cultivation.

Azores: Fayal, S. Miguel. St. Helena. Jamaica. Also found in England, France, Italy, Mamudly, Transcaucasia, etc.

Helix anconostoma LOWE, Cambr. Philos. Soc. Trans., iv, 1831, p. 62, pl. 6, f. 301. — *Pupa anconostoma* Lowe, PFR., Monogr., ii, 314; iii, 542; iv, 668; vi, 308. — *Pupa umbilicata* var. *anconostoma* Lwe., WOLLASTON, Testac. Atlant., pp. 211, 450.—*Pupilla anconostoma* MABILLE, Nouv. Archives du Mus., (2), viii, 1885, p. 157. — *Pupa grevillei* CHITTY, Contrib. to Conchology no. 1, 1853, p. 17 (Newton, St. Andrews Mts., Jamaica).—PFR., Monogr., iv, 666.—*Pupa nilssoni* WALLENGREN, Antekn. i Zoologien, 1856, p. 86, according to Westerlund. — *Pupa helenensis* PFR., Malak. Bl., iii, 1856, p. 207; Monographia, iv, 665 (St. Helena). *Cf.* Smith, P. Z. S., 1892, p. 259.

The relation of this form to *cylindracea* is not clear to me. The two are found together in some museum lots from Europe; whether they are associated in life, I do not know. A short form of *cylindracea,* generally called *curta* West., differs from short *anconostoma* by the more developed callous pad in the angle of the aperture.

Lowe noted two varieties. "(*a*), *gyrata:* shell lengthened, elbow of the aperture [angulation of the outer lip above] very distinct; length 1¾, diam. 1 line, 7 whorls." This may be regarded as typical *anconostoma.* "(*b*), *curta:* shell shortened; elbow of the aperture more obsolete; length 1¼, diam. ¾ line, 6 whorls." These are represented by figures 10, 4.3 mm. long, and 11, 3 mm., respectively. In several lots examined both short and long examples are present, in others only long and intermediate.

It is very abundant in Madeira, where the typical *cylindracea* has been found only in the Jardim da Serra. Both are regarded by Wollaston as introduced from the mainland. I can find no differences between shells of Madeira, Teneriffe, Hierro, Fayal and S. Miguel. A specimen from St. Helena (*P. helenensis*) is of the short form, *curta* Lowe.

Two sets of *P. grevillei* from Jamaica in coll. A. N. S., and a lot of 4 in U. S. N. M. (no. 331779), received from Chitty, are typical *anconostoma,* 3.5 to 3.7 mm. long. Whether it is colonized in Jamaica, or introduced into Chitty's collection by mistake, remains uncertain. No subsequent collector has found it there.

A. cylindracea misella Paulucci does not appear to differ materially from *anconostoma.* It was described thus: Differs from the type [of *cylindracea*] by the smaller shell, very fragile, without teeth or very minutely subdentate on the parietal wall; aperture narrower, rounded; peristome less reflected, somewhat narrowed. Length 3, diam. 1.75 mm. Sardinia: forests of Monte Cresia and Valle del Tacquisara, with the typical form (*Paulucci*).

Lauria cylindracea dohrni (Pfr.). Pl. 6, figs. 13, 14, 15.

Shell rimate, ovate, glossy, pellucid, delicately striatulate, brownish-corneous; spire convex, obtuse; 6 slightly convex whorls, the last about two-fifths of the length, compressed at base, slightly ascending in front; aperture oblique, sinuate-oval, with a single compressed, lamelliform tooth on the parietal wall at the insertion of the lip; peristome angularly reflected, the right margin attenuate and sinuous above. Length 3 to 3½, diam. 1¾ to 2 mm., diam. apert. 1 mm. (*Dohrn*).

The shell is very similar to the larger examples of *anconostoma.* The lip is well reflected but narrow, brownish; there is no columellar lamella in the typical form from S. Antao (but it is present in those of S. Nicolao, form *perdubia*). The base is perceptibly more rounded, less compressed than in *anconostoma.*

Length 3, diam. 1.8 mm., 5½ whorls, topotype from Dohrn.

Length 3.5, diam. 1.9 mm., barely 6 whorls.

Cape Verde Islands: S. Antao, in the Ribeira de Joao Affonso (Dohrn). S. Nicolao (Lowe).

Pupa milleri DOHRN, Malak. Bl., xvi, 1869, p. 11. Not *P. milleri* Pfr., 1867. — *Pupa dohrni* PFR., Monographia, viii, 1877, p. 371.—WOLLASTON, Testac. Atlant., p. 513. Not *Pupa dhorni* Desh., 1864.

This form stands so close to *anconostoma* that its distinction may be superfluous, as Wollaston evidently thought.

The S. Nicolao form, *perdubia* Woll., pl. 6, figs. 14, 15, is a little less conic, being wider in the spire, and showing a distinct if low columellar lamella. Length 3.3, diam. 1.7 mm., or shorter. It stands extremely close to *anconostoma.* Figured from a Wollaston specimen in the Tomlin collection.

A young specimen of *perdubia,* pl. 6, fig. 14, of 4 whorls, shows four palatal laminæ at closer intervals than in any *anconostoma* or *cylindracea* seen. In another smaller shell there are three laminæ at similarly close intervals.

Deshayes' name *Pupa dhorni* was presumably an error for *dohrni;* Sandberger has referred to it as *Carychiopsis dohrni.* In the absence of proof of error, the name can hardly be held to invalidate *P. dohrni* Pfr.

2. LAURIA UMBILICUS (Roth). Pl. 6, figs. 19, 20.

The shell is narrowly umbilicate within, the *umbilicus enlarging funnel-like* at the opening; ovate, thin, dilute brown, somewhat transparent, weakly striatulate. The whorls are moderately convex, the last somewhat contracted behind the aperture, pinched out below to form *a prominent keel around the umbilicus,* the keel bordered by an impressed line within the latter. The aperture is somewhat narrowed and subangular basally. Lip reflected, thickened within, the thickening excised above. A small angular lamella connects with the outer lip-insertion, and is continued inward as a thread-like lamella. No columellar lamella. Length 2.9, diam. 1.5 mm.; 5½ whorls.

Greece: Island of Syra (Roth and others). Southern Dalmatia and Albania (Kuester).

Pupa umbilicus ROTH, Molluscorum species quas in itinere per Orientem etc., Diss. Inaug., 1839, p. 20, pl. 2, f. 3.—KUESTER, Conch. Cab., p. 25, pl. 3, f. 18, 19.—PFR., Monogr., ii, 330; iii, 542.

This has been considered a variety of *L. cylindracea* by Kobelt. It differs from that by the much more strongly developed basal keel; and until intergradation is demonstrated, may well be left apart. The figured specimen is from S. Giorgio, Syria.

3. LAURIA VULCANICA (Kuester). Pl. 7, fig. 1.

The shell is very small, egg-shaped, very blunt, nearly smooth with a silky luster, thin-walled, transparent; color horn-yellow or pale yellow. Base compressed; neck round, scarcely contracted; umbilical opening round, deeply penetrating. Aperture large, ovate-rounded, free; one small tooth only on the parietal wall. Peristome sharp, little reflected. Length 1⅓, diam. ⅔ lines. Animal blackish, lighter beneath (*Kuester*).

Sardinia: in the pores of lava blocks of the tumbled-down crater of an extinct volcano near Nurri; few specimens (Kuester); waterfall at Laconi (Caroti).

Pupa vulcanica KUESTER, Conchyl. Cab., 18.., p. 18, pt. 2, f. 23, 24.—PAULUCCI, Bull. Soc. Malac. Italiana, viii, 1882, p. 282.—*Pupa rupestris* Kuester, ANTON, Verzeichniss, p. 47, no. 1736; not of Philippi.

This appears to be a thin, *anconostoma*-like form, perhaps closer to *sempronii*, from a station deficient in lime. Kuester's size-figure is 3.3 mm. long. Mme. Paulucci states that fine, oblique striæ are distinctly seen under sufficient magnification, and that the immature stage has a second lamella inward on the columella. So far as I can learn, it has been collected only twice, and is one of the rarest European species.

4. LAURIA SEMPRONII (Charp.). Pl. 7, figs. 2, 3.

The shell is most minutely perforate, shortly rimate, cylindric-tapering with blunt, rounded summit, transparent pale tawny-olive, glossy, smooth. The whorls are moderately convex, the last narrowly rounded basally, the base little compressed only near the lip. The aperture is truncate-oval. Peristome is very narrowly reflected and a little thickened at the inner edge; outer lip sinuated above. A small, short angular lamella stands upon the parietal wall near the outer lip-insertion, with which it is very weakly connected in the most strongly developed examples. Columella smooth.

Length 3.1, diam. 1.4 mm.; 6 whorls. Lombardy. Fig. 3.

Length 2.4, diam. 1.5 mm.; 5½ whorls. Lombardy. Fig. 2.

Entire Alpic region, Sardinia, Balkan Peninsula and Caucasus.

Pupa sempronii CHARPENTIER, Cat. Moll. terr. et fluv. Suisse, in Nouv. Mém. Soc. Helvet. Sci. Nat., i, 1837, p. 15, pl. 2, f. 4 (on granitic rocks around Gondo, on the southern slope of the Simplon, type loc.).—PAULUCCI, Bull. Soc. Malac. Italiana, viii, p. 280, with var. *dilucida*, p. 281 (both from Osini and valley of Tacquisara, Sardinia); Materiaux Faune Malac. Italie, 1878, p. 10 (dist. in Italy).—PINI, Bull. Soc. Malac. Ital., ii, p. 164 (localities in the Esino district).—BOETTGER, Jahrb. D. malak. Ges., viii, p. 228 (Kutais, Transcaucasia).—*Odostomia sempronii* Charp. CLESSIN, Molluskenfauna Oesterreich-Ungarns, 1887, p. 253, f. 153, with var. *dilucida*, p. 254, f. 154 (Tyrol).—*Pupilla sempronii* Charp., LOCARD, Ann. Soc. Agric. Lyon (7), iii, 1895, (1896), p. 215. —*Lauria sempronii* Charp., KOBELT, Iconogr. n. F., viii, p. 70, pl. 231, f. 1486.

Pupa sempronii var. *edentula* GREDLER, Pfr.-Cless., Nomencl. Hel. Viv., p. 353, as synonym of *P. dilucida*.

Pupa dilucida Ziegler, ROSSMAESSLER, Iconogr., i, pt. 5, 1837, p. 15, f. 326.—PFR., Monogr., ii, 304.—DUPUY, Journ. de Conch., xxv, 18 (descr. of living animal).—*Pupilla dilucida* Ziegl., LOCARD, t. c., p. 216 (le Midi, Gers, Hérault, Haute-Garonne, Gironde, Alpes-Maritimes).

Helix vallisnerii DE STEFANI, Bull. Soc. Malac. Ital., v, 1879, p. 39 (immature stage).

It is much smaller than any form of *cylindracea*, more delicate and transparent, and with only a very small angular lamella, which sometimes continues as a delicate thread a third of a whorl inward, but more frequently the thread is shorter or wanting. It has a columellar lamella in the young, but none is visible in adult shells examined from France, Switzerland (Lausanne), Lombardy and the Tyrol.

De Stefani described the immature stage as having spirally entering columellar and parietal lamellæ, with raised, triangular denticles, not very distantly spaced.

Like *cylindracea*, the specimens of any lot may vary remarkably in length. The toothless variety *dilucida* is said to occur with *sempronii* in some places, but some authors have regarded it as a distinct species. I cannot decide upon its status.

L. sempronii dilucida (Zgl., Rossm.). Pl. 7, fig. 4.

Aperture toothless. The length is given as 1½, width ¾ lines. Type locality, Maultaschen Höhle in the Tyrolese Alps, discovered by Stenz, jr.; reported also from many places from France to Greece. A specimen from Kalamata, Greece, fig. 4, measures 2.4, 1.3 mm., 5¼ whorls.

Gredler has recorded *dilucida* from the Austrian Tyrol, and is said to have named this form *P. sempronii* var. *edentula.* I have not been able to trace the original source of this name, which in any case would be later than *dilucida.*

5. Lauria fagoti Westerlund.

Shell half-covered perforate, obese, subovate, very obtuse, corneous, smooth, glossy. Whorls 5, the upper ones slowly regularly increasing, convex, suture deep, the last twice as large, convex, horizontal in front. Aperture semioval, the external margin regularly arcuate, columella subvertical, dilated and reflected above. One thin very long parietal lamella and one acute tooth on the columella. Length 1.75, diam. 1.25 mm. (*West.*).

Spain: Sarria, prov. Gerona (Cleve coll., in Upsala).

Lauria fagoti West., Synopsis Moll. Extramar. Reg. Palæarcticæ, 1897, p. 66; Nachrblatt., 1894, p. 171.

Seems to be close to *sempronii,* but shorter, with a columellar lamella. Known only by the original account.

6. Lauria caspia (Pfr.). Pl. 7, figs. 5, 6.

Shell perforate, ovate-cylindric, thin, smooth, pellucid, glossy, fulvous-corneous. Spire oblong, slowly tapering upward, obtuse at apex; suture impressed. 6½ rather convex whorls increase regularly and slowly, the last more than one-fourth the length, not descending in front, rounded basally. Aperture slightly oblique, truncate-oblong, with a small, compressed, very shortly entering parietal tooth. Peristome thin, the right margin narrowly expanded, sometimes somewhat flexuose, columellar margin dilated, reflected. Length 3, diam. 1⅓ mm. (*Pfr.*).

Length 2.6, diam. 1.4 mm. Lenkoran specimen.

Transcaucasia: Lenkoran, near the Caspian Sea, under the bark of *Pterocarya caspia* (Dr. Sievers).

Pupa caspia Pfr., Malak. Bl., xviii, 1871, p. 70; Monogr., viii, p. 364.—Mousson, Journ. de Conchyl., xxi, 1873, p. 213, pl. 8, f. 9.—BOETTGER, Jahrb. D. m. Ges., vi, p. 403 (Lenkoran); viii, p. 228.

This species stands very near *L. sempronii,* but it differs, as Boettger has pointed out, by the far stronger lamella running inward, and continuing as high within as at the aperture, as seen in the obliquely basal view, fig. 5; the whorls are less convex, the last one not so high. It is rather more openly perforate. There is no columellar lamella. Possibly it will be found to intergrade with *sempronii,* but at present it appears to be distinct. A Lenkoran specimen is figured.

7. LAURIA FANALENSIS (Lowe). Pl. 7, figs. 7 to 10.

Allied to *P. anconostoma.* It differs by the shorter, more obese and more ovate form, somewhat wider at base, the whorls more convex, suture impressed, the aperture rounded basally, not angular, the ventral fold stronger, and the umbilical keel obsolete (*Lowe*).

The shell is most minutely perforate and very shortly rimate, very thin; dilute, transparent isabella color; glossy, weakly striatulate. The whorls increase more rapidly than in the short form of *anconostoma.* Summit obtuse. The last whorl is *well rounded basally,* not compressed. Peristome is narrow. Angular lamella small, slender, not connecting with the outer lip-insertion. A low, thread-like columellar lamella emerges weakly.

Length 2.5, diam. 1.45 mm.; 5 whorls.

Length 2.4, diam. 1.5 mm.; 4¾ whorls.

Madeira: at the Cruzinhas and the Fanal and Lombarda das Vacas; in damp sylvan spots near the highest altitudes, among moss and lichen on the trunks of laurels and on ferns (Lowe and Wollaston). Canaries on Teneriffe in similar stations, wood of Las Mercedas; above Taganana, at the Agua Mansa, and near Ycod-el-alto; and Palma in the Barranco de Agua, Barranco de Galga, and ascent of the Cumbre above Buenavista (*Wollaston*).

Pupa fanalensis LOWE, Ann. Mag. N. H. (2), ix, April, 1852, p. 275.—WOLLASTON, Testacea Atlantica, 1878, p. 209, 449.—*Pupa debilis* MOUSSON, Rev. faune Malac. Canar., 1872, p.

124, pl. 6, f. 16, 17; Novit. Conch., iv, p. 106, pl. 125, f. 16, 17. —Ancey, Journ. de Conch., 1901, p. 140.—*Pupa pyramidula* Ponsonby & Sykes, Proc. Malac. Soc. London, i, 1894, p. 55, text-fig.

It is smaller and more fragile than the short form of *anconostoma,* and the base is well rounded, with scarcely any trace of the compression and angulation of *L. cylindracea,* also shared in a less marked degree by *L. c. anconostoma.* The aperture is more rounded than in *L. sempronii,* and there are fewer whorls in shells of equal length.

There seems to be very little difference between specimens of Madeira (figs. 7, 8) and Teneriffe (figs. 9, 10), as Wollaston has stated; but in both islands there is considerable variation in shape. The figures are from examples from the Lowe-Wollaston collection. Two Teneriffe specimens measure:

Length 2.5, diam. 1.5 mm., 5 whorls.

Length 2.15, diam. 1.45 mm., 4½ whorls.

A young shell of slightly over 3 whorls shows two minute, tubercular basal teeth (pl. 7, fig. 14). In one of a little more than 4 whorls (fig. 13) the teeth are radially elongate. Both from Barranca de Agua, Palma, Canaries.

Mousson's description of the Canarian *P. debilis* follows. It appears not to differ from *fanalensis,* but the type should also be compared with *pyramidula.* Mousson's figure is here reproduced.

Pupa debilis Mousson. Pl. 7, fig. 15. Shell minute, rimate-perforate, globose-ovate, thin, pellucid, slightly striatulate, glossy, pale corneous. Spire short, narrowly rounded, the summit obtuse; suture somewhat impressed. Six slightly convex whorls, the last larger, rounded, somewhat inflated above, equably rotund beneath, very slightly compressed at the umbilical crevice. Aperture vertical (10° with the axis), ovate-semicircular, curved, and not angular at base. Peristome slightly thickened, very narrowly reflected, the margins remote, a weak compressed tooth at the right third of the parietal interval; right margin regularly curved, sometimes thickened a little above; columellar slightly reflected. Columella straight or gently curved. Length 1.5 [doubtless an error for 2.5], diam. 1 mm. Teneriffe, Canaries (*Mousson*).

Lauria fanalensis pyramidula (P. & S.). Pl. 7, figs. 11, 12.

The form named *pyramidula* P. & S. is more robust and darker colored than typical *fanalensis.* One of the original lot (fig. 11) measures: 2.7 x 1.6 mm., 5¼ whorls. The original description follows.

Pupa pyramidula Ponsonby & Sykes. Shell small, conic, unicolored brown, thin; whorls 5½, rather swollen, longitudinally very lightly striate, the last inflated, large; spire obtuse, rather flattened, the apex minute; aperture semioval, provided with a thin, oblique, entering plait at the insertion of the right margin; margins remote, narrowly reflected throughout; umbilicus moderate, funnel-shaped. Length 3.5, width 1.5 mm. Icod, Island of Teneriffe.

Ethiopian Species.

As a whole, these forms are remarkably similar to those of Europe. The Abyssinian species, *bruguierei,* differs but little, in the adult stage, from some forms of *L. cylindracea anconostoma* and the scarcely separable *dohrni* of the Cape Verdes.

The single Mascarene species known, *L. bourbonensis,* stands a little apart by the very thin anterior end of the angular lamella, which is more removed from the lip-insertion than in the Cape species. The Cape of Good Hope species are not far from the same type, though certainly distinct specifically. They form an intimately related group, separable by the following characters:

a^1. Angular lamella long, curving into the interior, its outer end not quite connected with the lip-insertion.
  b^1. Base subangular; length 3.4 to 4.24 mm. *L. farquhari,* no. 11.
  b^2. Base narrowly rounded; length 3 to 3.5 mm.
    c^1. Radial basal laminæ strongly developed in the early stage, persisting weakly nearly to maturity. *L. cryptoplax,* no. 13.
    c^2. Basal laminæ very small, present only in earlier youth. *L. dadion,* no. 12.
a^2. Angular lamella short, its outer end connected with the lip-insertion; base pinched out into a short, blunt keel. *L. tabularis,* no. 14.

These species have been known chiefly from excellent drawings by Burnup, published by Melvill and Ponsonby. The author is indebted to Messrs. Burnup and Farquhar, and to Major Connolly for series of specimens.

Whether *L. tabularis* is really distinguishable from *cylindracea,* and *L. dadion* from *anconostoma* are questions remaining open. Both may be imported forms—a view I am much disposed to accept. Yet, as there are several unquestionably endemic South-African species, the possibility of convergent evolution of European and Cape forms (all from very similar ancestors) must be considered. Possibly a thorough study of the young may assist the decision.

8. Lauria bruguierei (Jickeli). Pl. 8, figs. 17, 20.

Shell perforate, cylindric-oblong, rather solid, glossy, diaphanous, brown, under the lens very delicately, irregularly striatulate. Spire high-conic, the apex obtuse. Whorls 6⅓, a little convex, slowly increasing, separated by an impressed suture, the last somewhat compressed at base, slightly ascending to the aperture. Aperture oblique, ovate-rounded, one-toothed, the tooth situated in the outer angle on the parietal wall. Peristome white-lipped, exanded, a little reflected, the margins approaching. Columella with an obsolete fold. Length 3¼, diam. 1¾, aperture 1¼ x 1 mm. (*Jickeli*).

Southern Abyssinia (Heuglin and Steudner); Enjelal and Bagla, Habab Mts., at about 7995 ft., under stones (*Jickeli*).

Pupa bruguierei Jickeli, Nova Acta Acad. Caes. Leop.-Carol. Germ. Nat. Cur., vol. 37, 1875, p. 112, pl. 5, f. 5, 6.—*Pupa heuglini* Krauss in coll.—*Pupa umbilicata* Martens, Malak. Bl., 1866, p. 96; 1870, p. 84.—*? Pupa* undet. near *umbilicata,* Blanford, Geol. and Zool. Abyssinia, p. 477.

It is very close to *L. cylindracea,* particularly the Cape Verde form *dohrni;* also to the South African *L. dadion.* The base is rounded, as in the latter, being less compressed than *L. cylindracea.* Jickeli found that the embryonic young have angular and columellar lamellæ and a transverse basal fold (fig. 17), while in *cylindracea* of the same stage (fig. 18) he found no armature in the basal wall.

In a specimen from Jickeli (pl. 8, fig. 20), length 3.3, diam. 1.6 mm., the contour differs somewhat from *dadion,* the latter being wider below.

9. LAURIA DESIDERATA (Preston). Pl. 8, fig. 16.

Shell small, turbinate, with very obtuse apex, reddish brown; whorls 5½, rather slowly increasing, moderately convex, the last ascending in front; suture well impressed; umbilicus broad, somewhat deep, partly concealed by the reflexion of the columellar margin; columella descending very obliquely, bearing rather interiorly a single plait, labrum whitish, sinuous, reflexed, projecting inwardly at a point some little distance below its junction with the parietal wall, which bears a weak, very oblique lamella; aperture irregularly quadrate. Alt. 3, diam. maj. 2 mm.; aperture, alt. .75, diam. .5 mm. (*Preston*).

British East Africa: Mount Kenia, at an altitude of 9,000-10,000 feet.

Jaminia desiderata PRESTON, Ann. Mag. N. H. (8), vii, May 1911, p. 470, pl. 11, f. 21.

If this is a *Lauria,* as I suppose, the angular lamella is rather more removed from the lip-insertion than usual, much as in *L. bourbonensis.*

10. LAURIA BOURBONENSIS n. sp. Pl. 8, fig. 19.

The shell is cylindric-ovate with obtuse summit, minutely perforate, rimate, brown, slightly translucent, somewhat glossy; very finely but obsoletely striatulate. Whorls not very convex, the last rounded below, compressed within the umbilical region. Aperture ovate, truncate. Peristome pale brown, very narrowly reflected, thin, very slightly thickened within. Angular lamella very thin throughout, slightly higher near the outer end, which falls short of the edge of the thin parietal film, and is some distance from the lip-insertion, but connected therewith by an extremely low callous ridge, hardly discernible except in the oldest examples. Inwardly the angular lamella penetrates as a whitish thread about a half-whorl—at least as far as can be seen in the mouth. Columellar lamella immersed, visible in an oblique view as a small median prominence.

Length 3.1, diam. 1.7.; 5½ whorls.

Island of Bourbon (Nevill).

The simplicity of the anterior end of the angular lamella, which is removed further than usual from the lip-insertion, differentiates this species from *L. dadion,* which is also somewhat longer, less striate and has a thickened white lip.

Five specimens in the type lot were collected by Nevill, who labelled them *P. pupula* Dh.—a species of *Pupilla.*

11. Lauria farquhari (Melv. & Pons.). Pl. 8, figs. 1, 2.

The shell is cylindric-tapering with obtuse, rounded summit, perforate and rimate, with a funnel-shaped umbilical area bounded by a basal angulation; light brown, somewhat translucent; smoothish, with very fine, faint striation. The whorls are somewhat convex, the last a little compressed basally, and in typical specimens the base is distinctly angular or subangular (but in some examples this is not so conspicuous. The peristome is narrowly reflected, flattened, and narrowly thickened at the inner edge, the thickening excised at the sinulus. The thin angular lamella gives off a short branch towards the lip-insertion, but separated from it by a narrow channel. It runs inward about one-third of a whorl. The columella bears a small, oblique lamella, emerging nearly to the peristome.

Length 3.8, diam. 1.9 mm.; 6½ whorls.

Length 3.4, diam. 1.8 mm.; 6¼ whorls.

Cape of Good Hope: Top of Elandsberg Mt., Cradock district (Farquhar).

Pupa farquhari Melvill & Ponsonby, Ann. Mag. N. H. (7), ii, 1898, p. 128, pl. 7, f. 7; (8), i, 1908, p. 74, pl. 1, f. 7.

While this species stands close to *L. dadion,* it differs by the somewhat larger size and greater number of whorls; more especially by the subangular base and somewhat more funnel-shaped umbilical opening, the perforation of which is small, about as in *dadion.* There are no young ones in several lots seen. It varies from 3.93 to 4.24 mm. long, according to M.

& P., but in one lot seen some specimens are smaller. Figured from topotypes received from Farquhar.

12. LAURIA DADION (Bens.). Pl. 8, figs. 3, 4, 5, 6.

Shell rimate-umbilicate, ovate-conic, subcylindric, obliquely striatulate, shining, translucid, olivaceous-corneous. Spire conoid-cylindric, the suture impressed, apex obtuse. Whorls 6, convex, the last compressed around the umbilicus. Aperture slightly oblique, angular-ovate; peristome a little reflected, whitish; columellar margin expanded, deep within, parietal provided above with a whitish entering fold. Length 3½, diam. 2 mm. (*Bens.*).

Cape of Good Hope: eastern side of Table Mountain, and also at Simonstown (Benson); Simonstown; ravine near Newlands (Layard); Bedford (Farquhar). Natal: Umvoti Country (Lightfoot); Karkloof; Nottingham Road; Inhluzani Mt.; Game Pass (Burnup).

Pupa dadion BENSON, Ann. Mag. N. H. (3), xiii, 1864, p. 495. — PFR., Monogr., vi, 320. — MELVILL & PONSONBY, Ann. Mag. N. H. (8), i, 1908, p. 72, pl. 1, f. 3. — *Jaminia dadion* (Benson), CONNOLLY, Ann. S. Afr. Mus., xi, pt. 3, p. 179 (distribution).—*? Pupa umbilicata* GIBBONS, Journ. of Conch., ii, 282 (abundant in garden hedges about Cape Town). — *Pupa dadioa* Bens., PFEIFFER-CLESSIN, Nomencl. Hel. Viv., p. 354.

The shell is perforate and shortly rimate. The base, while somewhat compressed, is rounded, not pinched up as in *tabularis*. The small angular lamella is enlarged at the anterior end and has a slight tendency to be forked there; inward it penetrates about a third of a whorl. The columellar lamella is merely a low, blunt prominence. A Simonstown specimen measures: length 3.2, diam. above aperture 1.6 mm., 6 whorls. Melvill & Ponsonby give the measurements of a paratype as 3.1 x 1.76 mm., evidently measuring to the edge of outer lip.

A young specimen from Karkloof, pl. 8, fig. 5, diam. 1.2 mm., has the usual strong columellar and angular lamellæ, and three delicate baso-palatal folds, not so strong as usual in *L. cylindracea* but spaced about the same. Other equally young ones show one of these folds or none, and there are none in the larger immature shells seen. There is an evident tendency to lose the folds in this species.

In a fully formed embryo, 0.85 mm. in diameter, of 1½ whorls, there is a quite short but rather high angular lamella only (fig. 6).

Mr. Burnup informs me that he has observed two pairs of tentacles in the living animal.

13. Lauria cryptoplax (Melv. & Pons.). Pl. 8, figs. 7, 8, 9, 10.

The shell is minutely perforate and shortly rimate, cylindric-tapering, with obtuse summit; brown, glossy and smoothish. The whorls are slightly convex, the last with rounded base. Peristome narrowly reflected, thin, a little thickened within. Angular lamella is small, slightly higher at the outer end, where it gives off a small spur towards, but not quite reaching, the lip-insertion. It penetrates as a well-developed thread from a third to a half whorl inward. Columellar lamella appears deep within as a small prominence.

Length 3.3, diam. 1.5 mm.; fully 6 whorls.

Length 3.36, diam. 1.95 mm. (fig. 9).

Length 3.12, diam. 2 mm. (Burnup).

Cape of Good Hope: Kragga Kama, Port Elizabeth (Crawford, Reeve); The Gorge, Somerset East (H. C. Burnup).

Pupa cryptoplax Melvill & Ponsonby, Ann. Mag. N. H. (7), iv, 1899, p. 198, pl. 3, f. 11; (8), i, 1908, p. 71, pl. 1, f. 1, 2.—Burnup, A. M. N. H. (8), vii, 1911, p. 402.

Very close to *L. dadion,* the adult stage scarcely distinguishable; but the armature of the immature stages is stronger and persists longer.

A half-grown specimen has three strong basal laminæ at intervals of ¼ whorl. The angular and columellar lamellæ are long and strong (pl. 8, fig. 8). A shell of 5½ whorls, therefore within a half-whorl of maturity, still shows two moderately developed basal laminæ.

14. Lauria tabularis (Melv. & Pons.). Pl. 8, figs. 11 to 15.

The shell is long-ovate, minutely perforate, rimate, light brown, smoothish; whorls are somewhat convex, the last compressed below, the base being pinched up in a short, rounded keel behind the basal lip, generally defined by an impressed line. Peristome is rather broadly reflected, flattened, thickened within, narrowed at the sinulus. Angular lamella somewhat triangular as seen from below, a callus spreading from it toward and joining the lip-insertion. Its *inward extension is very short* (pl. 8, fig. 15). The columella is simple (or sometimes shows a faint prominence deep within).

Length 3.25, diam. 1.6 mm.; 6 whorls.

Length 3.1, diam. 1.6 mm.; 5¾ whorls.

Cape of Good Hope: Cape Town (Lightfoot, type loc.); Rondebosch (Connolly).

Pupa tabularis MELVILL & PONSONBY, Ann. Mag. N. H. (7), xi, 1893, p. 20, pl. 3, f. 3; (8), i, 1908, p. 82, pl. 2, f. 22.—BURNUP, A. M. N. H. (8), vii, 1911, p. 410.—*Jaminia tabularis* (M. & P.), CONNOLLY, Ann. S. Afr. Mus., xi, pt. 3, 1912, p. 184.

The short keel pinched up at the base (fig. 15) is a conspicuous feature of this shell, though somewhat variable in prominence. The rather wide lip and especially the very short angular lamella are characteristic. Other species of the region have the angular lamella continued much further inward.

No very young shells are at hand, but one of nearly 5 whorls shows a well-marked though low lamella on the parietal wall, an extremely minute, deeply immersed columellar, and two minute tubercular basal folds, situated as in *dadion* but much smaller. Several specimens somewhat larger show no baso-palatals, no columellar and only a very slight thread on the parietal wall.

In one adult Cape Town specimen (pl. 8, fig. 12) the angular lamella is reduced to a little callous pad joined to the lip insertion.

This species is certainly very similar to *L. cylindracea*, which many years ago was reported from the Cape (as *Pupa umbilicata* Drap., by Gibbons, Journ. of Conch., ii, 1879, p. 282, ''abundant in garden hedges about Cape Town''). Further series of the immature stages should be examined, as the few seen show teeth far smaller than the European species.

L. tabularis appears to have a shorter angular lamella than usual in *cylindracea*. See also under *L. dadion*.

Subgenus Leiostyla Lowe.

Leiostyla Lowe, Ann. Mag. N. H. (2), ix, April 1852, p. 276, for *P. vincta, irrigua, laurinia, laevigata, recta, macilenta;* P. Z. S., 1854, p. 208, "type *P. anglica* Fér."—*Liostyla* Lowe, v. Martens, Die Heliceen, 1860, p. 293.

Alvearella Lowe, Ann. Mag. (2), ix, 1852, p. 277; P. Z. S., 1854, p. 212, *P. cassidula* designated type.

Charadrobia Albers, Malacographie Maderensis, 1854, p. 63.—v. Martens, Die Heliceen, p. 293, type *Pupa cheilogona* Lwe.

Caucasica Caziot et Margier, Bull. Soc. Zool. France, xxxiv, 1909, p. 141; *P. caucasica* type by tautonymy.

The shell has, in addition to the deeply entering angular and columellar lamellæ of *Lauria* proper, a parietal lamella and one or more palatal folds. Immature (neanic) stage having angular and columellar lamellæ, usually also a parietal; radial teeth in the base as in *Lauria* proper. *The animal is oviparous.*

Type *L. vincta* (Lowe). Distribution, islands of the Atlantic, western Europe, Caucasus region.

Leiostyla, like *Lauria* proper, is markedly discontinuous in distribution, the colonies in the British Islands, Portugal, Algeria, the Caucasus region and the islands of the Atlantic are all of small area and are completely isolated. The assemblages of Madeira and the Caucasus may be traceable to more than one migration, or in other words, may have descended from more than one ancestral stock for each, but this can only be demonstrated by further discoveries in the Tertiary. At present there seems no conclusive evidence that either the Caucasian or the Madeiran series is di- or polyphyletic, as all of the Tertiary species (possibly excepting *L. minax*) belong to the typical *L. anglica* group of *Leiostyla*. The *L. cheilogona* group is probably the most primitive of the Madeirans, being very close to Tertiary species of Europe, to the Recent British species, and to such Caucasian forms as *L. tenuimarginata*.

Part of the Madeiran species agree closely with the European *L. anglica*. Others have no callus connecting angular lamella and lip-insertion, thereby agreeing with the species of the Azores and Canaries, and with the Transcaucasian *L. tenuimarginata*. The Porto Santo species are closely related to part of those of Madeira, but the hydrophilous Madeiran groups have no representatives on the smaller, dryer island.

Key to Species of Leiostyla.

1 Species of Western Europe, British Islands to Algeria (2)
Species of the Caucasus and adjacent regions (4)
Species of the Atlantic islands, Madeira, Azores and Canaries (12)

Species of Western Europe, Britain to Algeria.

2 Base with a wide, deep umbilicus as in *L. cylindracea*; surface with strong, regular striæ; Portugal. *L. paulinoi*, no. 23
Base minutely perforate and openly rimate (3)

3 Smoothish; angular lamella connected by a callus with the lip insertion; British Is., Portugal. *L. anglica*, no. 22
Finely subcostulate; angular lamella free from the lip insertion; Algeria. *L. numidica*, no. 24

Species of the Caucasus and Adjacent Regions.

4 Columellar lamella forming a broad and steeply ascending plate deep within (5)
Columellar lamella entering horizontally, ascending but little deep within, its edge slanting downward (6)

5 Smoothish; about 5 or 6 mm. long; columellar lamella not emerging. *L. caucasica*, no. 15
Finely striate; 3.2 to 3.5 mm. long; one or two columellar lamellæ emerging. *L. paulinæ*, no. 16

6 Surface smoothish (7)
Surface distinctly ribbed or rib-striate (10)

7 Outer lip strongly bent in below the sinulus; peristome thick, crenulate; 3.5 to 4 mm. long. *L. zonata*, no. 19
Outer lip not bent in below the sinulus (8)

8 Length less than 3 mm. *L. tenuimarginata*, no. 17
Length more than 4 mm. (9)

9 Small basal and upper-palatal folds present; peristome thick, crenulate; 4.2 to 5 mm. long. *L. superstructa*, no. 18
A small basal fold but no entering upper-palatal; peristome simple, whitish; 5.25 mm. long. *L. s. lederi*, no. 18*a*
No basal or entering upper-palatal folds; 4.6 to 5 mm. long. *L. s. unibasalis*, no. 18*b*

10 Perforate and rimate, the base rounded; 2 lamellæ on columella; lip crenulate (11)
Deeply umbilicate, the base keeled; 1 lamella on columella. *L. pontica*, no. 21

11 Beautifully, sharply costulate; 3.5 to 4 mm. long. *L. pulchra*, no. 20
Finely rib-striate; glossy brown; 4 to 4.5 mm. long. *L. p. nitens*, no. 20*a*

Species of the Atlantic Islands.

12 Madeira group (13)
Azores (38)
Canary Islands (36)

(Madeiran Species.)

13 Parietal lamella higher than the angular, which is not connected with the lip insertion; teeth large, but the palatals and basal deeply immersed; lip-tooth strong, nearly closing the sinulus; shell small, ribbed, the diam. ⅔ to ¾ of the length of about 2 mm. (section *Wollastonula*). *L. gibba*, no. 46
Parietal lamella not higher than the angular, often distinctly lower (14)

14 Parietal lamella emerging about as far as the angular; shell ovate-conic, solid, closely rib-striate, with a very small umbilicus; 8 teeth, all emerging to the peristome; length 4 to 4.6 mm. (section *Scarabella*). *L. cassida*, no. 25
Parietal lamella, when present, emerging distinctly less than the angular (15)

15 Diam. about ⅔ the length; whorls strongly convex with lamellar ribs; angular lamella high within, the parietal lamella minute or wanting; columellar lamella and lower-palatal fold small; no other teeth; length 2 to 2.3 mm., 5½ whorls (section *Mastula*). *L. lamellosa*, no. 47
Not as above; generally relatively longer, or with more whorls (16)

16 Surface ribbed or rib-striate (17)
Surface smoothish or finely striate (28)

17 Aperture with 4 to 5 teeth; basal fold wanting or very small (18)
Aperture with 6 to 8 teeth (20)

18 Diam. more than half the length; a well-developed lip-tooth nearly closing the sinulus; lower-palatal fold long, deeply immersed, its place indicated by a shallow furrow externally; closely costulate; 3.25 to 3.6 mm. long; Madeira. *L. abbreviata*, no. 39
Diam. less than half the length; lip-tooth nearly obsolete or wanting, the sinulus open; Porto Santo (19)

19 Four well-developed teeth, rarely an additional upper-palatal and basal also; shell cylindric; 3.8 x 1.4 mm. *L. ferraria*, no. 42
Only the angular well developed; parietal, columellar and lower-palatal present but small, immersed; shell cylindric-tapering, 2 to 3 mm. long. *L. degenerata*, no. 43

20 Peristome continuous, the parietal callus raised, oblique; diam. less than ⅓ the length of over 4 mm. *L. relevata,* no. 41
Parietal callus adnate (21)

21 Very strongly ribbed; parietal lamella and basal fold very small; diam. more than half the length of 2.7 to 3.6 mm. *L. calathiscus,* no. 45
Costulate or rib-striate; parietal lamella well developed (22)

22 Diam. about 1.8 mm.; stout in figure (23)
Diam. 1 to 1.5 mm.; cylindric (24)

23 Ovate; subregularly, very finely costulate. *L. cassidula,* no. 30
Oblong-cylindric; irregularly striate. *L. l. transiens,* no. 29*a*

24 Length less than 2.75 mm. (25)
Length more than 3 mm. (27)

25 Whorls decidedly convex (26)
Whorls only weakly convex; very finely, sharply striate on the spire; 2.5 x 1.2 mm. *L. wollastoni,* no. 34

26 Lip-tooth defining the sinulus tubercular, well expressed; 5 to 5½ whorls. *L. millegrana,* no. 38
Upper tooth in the lip thin, entering, not prominent on the peristome; 6 whorls. *L. monticola,* no. 44

27 Lip-tooth defining the sinulus strongly developed; sculpture rather fine. *L. sphinctostoma,* no. 33
L. fusca, no. 37
Lip-tooth weak; sculpture of strong riblets; lip well reflected. *L. corneocostata,* no. 40

28 Angular lamella distinctly connected with the lip-insertion (29)
Angular lamella not connected with the lip insertion; no supracolumellar lamella; 4 to 6 teeth (32)

29 Lip-tooth defining the sinulus weak; shell long, cylindric, the diam. much less than half the length; a basal fold present (30)

Lip-tooth moderately developed; shell cylindric, diam. less than half the length; no basal fold; 3.7 x 1.5 mm. *L. s. simulator*, no. 33c

Lip-tooth moderately or strongly developed; shell more or less tapering upwards; diam. equaling or exceeding half the length (31)

30 Finely striate on the spire; supracolumellar lamella and upper-palatal fold well developed. *L. s. arborea*, no. 33*a*

Finely striate on the spire; a rather weak supracolumellar lamella and no distinct upper-palatal fold; 4.7 to 5 x 1.5 mm. *L. recta*, no. 36

More sharply striate throughout; no supracolumellar; 3.7 x 1.4 mm. *L. r. macilenta*, no. 36*a*

31 No supracolumellar lamella; callus connecting the angular lamella and lip insertion irregular, interrupted or tubercular. *L. laurinea*, no. 32

Supracolumellar lamella present; an even callus connecting the angular lamella and lip insertion.
L. irrigua, no. 28
L. loweana, no. 29

32 Parietal lamella small and short, not entering deeply; shell rather narrow, diam. less than half the length. *L. laevigata*, no. 35

Parietal lamella long, entering deeply; shell wider, diam. half the length or more (33)

33 Cylindric, the upper third convexly conic; sharply striate; lip-tooth below the sinulus well developed. *L. concinna*, no. 31

Somewhat tapering from the last whorl; an inward prominence below sinulus but not a definite tooth; striation weak (34)

34 Outlines of spire but slightly convex; aperture produced towards the outer-basal part. *L. cheilogona,* no. 26
Outlines of spire strongly convex; aperture not so produced (35)

35 Spire convexly conic; length 3 to 3.5 mm. *L. vincta,* no. 27
Spire thick in the upper part; length 4.4 mm. *L. v. watsoniana,* no. 27*a*

(Canary Island Species.)

36 Shell broadly ovate, the diam. 60 to 65 per cent of the length; chestnut above, the base pale; angular lamella not distinctly connected with the lip-insertion. *L. castanea,* no. 48
Shell narrower, oblong, the diam. 52 to 57 per cent of the length; angular lamella connected by a callus with the lip-insertion (37)

37 Chestnut above, the base pale; rather finely striate. *L. pythiella,* no. 49
Banded with chestnut on a pale ground; weakly plicatulate. *L. tæniata,* no. 50

(Azores Islands Species.)

38 Aperture with a small angular lamella continued inward as a thread, the columellar lamella small or immersed; no parietal or palatal teeth. *L. fasciolata,* no. 51
Three to six teeth present (39)

39 8 to 9 nearly flat whorls; aperture somewhat trilobed; two lamellæ on the columella. *L. tesselata,* no. 55
6 or fewer whorls (40)

40 Angular lamella connected with the lip-insertion; parietal lamella moderately developed (41)
Angular lamella large, widely separated from the lip-insertion, the parietal lamella very small or subobsolete; shell ovate, irregularly, coarsely ribbed. *L. vermiculosa,* no. 54

41	Finely striate.	*L. fuscidula,* no. 52
	Closely rib-striate.	*L. rugulosa,* no. 53

Species of the Caucasus and Transcaucasia.

The simpler species, such as *L. tenuimarginata,* closely resemble those of Western Europe and the less evolved forms of the Atlantic Islands; but in most of the species there is a tendency towards further development of the teeth and lip. This culminates in forms having a thick, *crenulated* lip recalling the Caucasian Clausilioid genus *Serrulina.* In others, such as *L. caucasica,* the columellar lamella is specialized. The species form three series:

Series of *L. caucasica* (section Caucasica C. & M.), species no. 15, 16.
Series of *L. tenuimarginata,* no. 17.
Series of *L. superstructa,* no. 18-21.

The following account is in large part given in the words of the able investigators Boettger, Retowski and Lindholm. The figures are chiefly from specimens received from the Boettger collection. I have not been able to obtain *L. paulinæ, L. pontica,* and some of the races of other species.

15. LAURIA CAUCASICA ('Parr.', Pfr.). Pl. 5, figs. 15, 16, 17.

Shell rimate, oblong-ovate, rather solid, smoothish, glossy, brownish corneous. Spire terminating in a rather obtuse cone; suture subcrenulate. Whorls 8½, rather flat, the last about one-third of the length, compressed at base. Aperture vertical, truncate-oval, contracted by 2 tooth-like parietal lamellæ, one subangular, flexuous, entering, the other deep within. Peristome whitish, a little expanded, 5-toothed: two short teeth and an entering fold on the right margin, one basal denticle, and one strong, oblique, deeply entering columellar lamella. Length 6, diam. 3 mm. (*Pfr.*).

Caucasus: Mt. Kasbek (Parreyss); Kobi, southeast of Kasbek, central Caucasus (Bttg.).

Pupa caucasica Parreyss, PFEIFFER, Malak. Bl., iv, 1857, p. 88; Monogr., iv, 675.

Pfeiffer's type has not been figured. The figures now given are from a somewhat smaller Kobi specimen. The thin but high angular lamella is connected by a callus with the lip-insertion. It bears a tubercle on the right, opposite the labral tubercle limiting the rounded sinulus. The parietal lamella is stouter, lower and much deeper in. The columellar lamella does not emerge, and forms a flat, steeply sloping plate deep within. The lower-palatal fold is high within; above it, and partially connected by an entering callus, there is a low entering fold, arising from the lip-callus a short distance below the sharp tubercle bounding the sinulus. The basal fold is exactly median and short. Length 4.9, diam. 2.4 mm., 7½ whorls.

16. LAURIA PAULINÆ Lindh.

The dextral shell is small, rimate, ventricose-ovate, thin, translucent, finely striate, hardly glossy, reddish-brown. The spire is inflated-conic, with convex sides and rather pointed apex. The 7 to 7½ convex whorls increase regularly and slowly, the last is about twice the height of the preceding, ascending in front, and somewhat compressed at the base. Suture impressed and nearly horizontal. The vertical aperture is truncate-oval, with two bays and narrowed by various teeth. The outer parietal [angular] fold is simple and high, the inner far lower and emerges less than the outer. On the outer margin there is a sort of tubercular denticle below the sinulus, below it a rather long and high palatal fold and a shorter basal fold. On the columella there are two short, horizontally placed brown folds, and behind them, in the interior, a nearly vertical, semicircular plate-like white lamella, which is well seen in an oblique view in the aperture, and shows through externally in the circum-umbilical region as a lightly bowed streak. The lip-margins are not connected, distinctly reflected, very thinly lipped; the outer margin is strongly impressed below the sinulus, the columellar oblique. Length 3.25–3.5, diam. 1.75–1.8 mm. (*Lindholm*).

Transcaucasia: near the railroad station Notanebi (37 werst northward of Batum), in swampy, mixed deciduous forest (Lindholm).

Lauria paulinæ LINDHOLM, Nachrbl. D. Malak. Ges., vol. 45, June 1913, p. 62.—*Lauria paulinæ* Ldh., subsp. *unicolumellaris* LINDHOLM, Nachrbl., vol. 46, 1914, p. 36.

By having a nearly vertical, semicircular lamella very deep within on the columella, this species appears related to *L. caucasica,* from which it differs by the folds of the columella. It appears to be quite unlike other known species of the region.

16*a*. *L. paulinæ unicolumellaris* Lindh.

This new form is distinguished from the type in that the columella bears only *one* horizontally placed fold, while in the type *two* such folds are present. Also, the vertical lamella deep in the interior, on the columella, is not white but brownish, and not quite so semicircular as in the type (*Lindholm*).

Transcaucasia: Mt. Salolet at Artwin (Gouv. Batum) in beech forest, 5300–5500 ft., two living adult specimens (Lindholm).

In size, color, sculpture and thinness of the peristome it agrees with the type, differing only in the armature of the aperture, as noted above (*Lindholm*).

17. LAURIA TENUIMARGINATA Boettger, n. sp. Pl. 10, figs. 1, 2.

The shell is perforate, very openly rimate, thin, pale olive-buff with a brown band on the last whorl, appearing above the suture on the penult. The surface has but little gloss and is smooth except for weak, fine growth-lines. The spire is convexly conic. Whorls are moderately convex, the last very slightly impressed in the place of the lower-palatal fold; suture distinctly ascending to the lip. The aperture is irregularly ovate. Angular lamella is very high, oblique, thin, a low callus connecting with the lip-insertion, and penetrating to the dorsal side. Parietal lamella much smaller and shorter. The columellar lamella emerges, slants downward and enters horizontally, penetrating to the ventral side. The lower-palatal fold is thin, moderately high, tapering at both ends, not emerging. There is a low denticulate callus between the low, wide lip-tooth and the lower-palatal. Basal fold very small, immersed. Peristome expanded, rather thin. Length 2.8, diam. above aperture 1.6 mm.; 7⅓ whorls.

Transcaucasia: Nolanebi. Type 130116 A. N. S. P., from the Boettger coll.

A second specimen (pl. 10, fig. 2) has scarcely any callus between angular lamella and lip-insertion, and there is only a smooth callus between the lip-tooth and the outer end of the lower-palatal fold—where the type has two denticles upon the callus. As in this specimen the peristome is less calloused within, it may not be absolutely mature.

This species is rather isolated among Caucasian Lauriæ. The smooth surface, rather thin lip, horizontally entering columellar lamella and small size are strikingly like the Madeiran group of *L. cheilogona* or the Azorean *L. fuscidula*. The resemblance to *L. vincta* Lowe is astonishing, general shape, color and teeth being nearly alike; but the Transcaucasian species differs by having more whorls in a smaller shell, there is an upper-palatal callus or denticles where *vincta* has none, and the lower tooth of the aperture is truly basal, whereas in *vincta* it is subcolumellar in position.

I have been unable to find Boettger's description of this species, if any was published.

18. LAURIA SUPERSTRUCTA (Mouss.). Pl. 9, figs. 1, 2, 3, 4.

Shell perforate-rimate, obtusely cylindric, well striated obliquely, a little glossy, pale corneous. Spire ovate-conic, the summit shortly conic, minute; suture slightly impressed. Eight whorls are closely coiled, the first a little convex, the rest flattened, the sixth largest, the last tapering, ascending in front, rounded, slightly compressed at the perforation. Aperture exactly vertical, one-third the length, broadly truncate-semioval, much contracted. Peristome strongly reflected, somewhat doubled, having a thick callus built up within; margins remote, joined by a thin layer, the right and columellar subparallel, basal curved. Folds 5, the 1st and 2d on the parietal wall, the latter median, deeply placed, the first lateral, stronger, joined to the margin by a sinuate callus; 3d and 4th on the columella, the lower one stronger; 5th compressed, erect behind, arising from the base of the outer margin; a long crest-like tooth in the middle of the right margin, 2 or 3 other minute fold-like, obsolete teeth in the basal margin. Length 5, diam. 2.5 mm. (*Mouss.*).

Transcaucasia: Lailasch, prov. Kutais (Mousson); Borschom, drift of the Kura at Michailowe, living at Kutais. Nakerala Mts., Imeretia (Leder), a small form. Suram Mts.

Pupa superstructa MOUSSON, Journ. de Conchyl., xxiv, 1876, p. 37, pl. 2, f. 7.—BOETTGER, Jahrb. D. m. Ges., vi, 1879, pp. 30, 404; vii, 1880, p. 138; viii, 1881, p. 229; x, 1883, p. 180, with var. *lederi*, pl. 7, f. 3; var. *zonata*, pl. 7, f. 2.—*Charadrobia superstructa* (Mouss.) var. *unibasalis* BOETTGER, Jahrb. D. m. Ges., xiii, 1886, p. 149, pl. 3, f. 5*a*-*b*.

A widely-spread Caucasian form, well distinguished by the thick, basally crenulate callus of the lip, the emerging columellar lamella, a short one above, the well-developed though short twin lamella connected with the angular lamella at its right base, and the short, directly entering upper-palatal fold. The surface has low traces, more or less obsolete, of rather coarse riblets; behind the well-expanded lip these are generally stronger. Length 4.7, diam. 2.4 mm., 7½ whorls. Mt. Suram.

A small form of the typical *superstructa* was found by Mr. Hans Leder in the Nakerala Mts., Imeretia. It differs from those of the region of Kutais only by the smaller size, recalling var. *zonata*, but it does not vary from the type in shape, form of the aperture or denticulation. Length 4¼, diam nearly 2¼ mm. (*Boettger*).

At Borschom (Leder, 1886) there is not rarely the trace of a dark band on the last whorl, the specimens otherwise typical.

Young shells of *superstructa*, Dr. Boettger (1879) writes, differ from those of *cylindracea*, aside from the shape, only by the longer internal radial welts, extending over nearly the whole breadth of the base, which are arranged like the spokes of a wheel, and closer together (so that there would be places for about 6 on the last whorl, though only the usual 3 or 4 are present) than in *cylindracea*, with which the lamellæ of youth otherwise agree in structure.

18*a*. *L. superstructa lederi* (Bttg.). Pl. 9, fig. 5.

Appearance of the shell and conformation of the peristome as in *caucasica* Pfr., but armature of the aperture that of *superstructa* Mouss. Shell larger than the type, more cylindric, paler, corneous-olivaceous; aperture not so wide, the right margin more impressed, the peristome simple, not doubled, whitish, not orange. No folds or denticles in the palatal margin except for a median, long palatal fold and a single punctiform denticle on the right margin and one in the base of the aperture. Length 5¼, diam. 2½ mm. (*Bttg.*).

Nakerale Mts., Imeretia, Hans Leder, one specimen.

Dr. Boettger further remarks in substance that this form differs from *superstructa* chiefly by the simple, thickened whitish lip, not doubled and not orange-colored. In dentition it differs by having the right parietal lamella arise from a wholly simple base, and its duplex nature only revealed by a scarcely noticeable little knot on the right side; the pointed tubercle on the right margin limiting the sinulus is not continued inward as a fold. Besides this tubercle, and with the exception of the long basal-lamella [lower-palatal fold] and the basal tubercle between this and the columellar lamella, no traces of any denticles are to be seen either within the mouth or on the thickening of the right margin. Figure reproduced from Boettger.

18*b*. *L. superstructa unibasalis* (Bttg.). Pl. 9, figs. 6, 7.

Differs from the type, of Kutais, by the non-tuberculiferous larger parietal [angular] lamella; a single palatal fold, there being no small upper one and none between the palatal fold and columellar lamella. Length 5, diam. 2⅗ mm. (*Bttg.*).

Suanetia. Fig. 6 after Boettger, fig. 7 a topotype from the Boettger collection. The absence of upper-palatal and basal folds readily distinguish this subspecies. Length 4.6, diam. 2.35 mm., 7⅓ whorls.

19. LAURIA ZONATA (Boettger). Pl. 9, figs. 8, 9, 10.

Much smaller than the type (of *superstructa*), uniform corneous-brown or generally paler, corneous-olivaceous with a distinct brown band. Aperture narrower, reversed ear-shaped, impressed below the sinulus and the umbilicus, being thus compressed laterally. The denticle of the right margin below the sinulus entering like a large lamella; the small fold between the median palatal fold and the columellar lamella nearer to the latter than the former; otherwise very like the type of *superstructa.* Length 4, diam. in middle 2 mm. (*Bttg.*).

Southeast and northern outliers of the Oschten-Fischt group, in forest, abundant; Mt. Guk, 3000 ft.; forests of the lower Kurdschips.

Pupa (Charadrobia) superstructa Mouss., var. *zonata* Boettger, Jahrb. D. m. Ges., x, 1883, p. 182, pl. 7, f. 2*a*-*b*.—*Lauria zonata* and mut. *albina* Bttg., Bericht Senckenb. naturf. Ges., 1889, p. 22.—*Pupa zonata* Bttg., Rosen, Nachrbl. D. m. Ges., 1905, p. 57.

First described as a variety of *superstructa*, Boettger in 1889 considered it specifically distinct, I think with good reason. He was influenced by the smaller size, the nearly constant reddish-brown spiral band, and especially by the pit-like impression behind the outer lip close below the sinulus, producing a strong inward bend of the lip itself; and also the presence of a strong palatal fold running obliquely inward, parallel to the angular lamella, and corresponding in position to the external pit. This is quite unlike the palatal fold of *superstructa,* which is nearer the lower-palatal fold, and runs directly inward. Compare figure 4, *superstructa,* and fig. 8, *zonata.*

As in *superstructa,* the thick peristome is cut into numerous denticles, strongest in the basal lip. Figured from a topotype out of the Boettger collection, 3.8 x 2 mm. Fig. 9 is reproduced from Boettger.

While the specimens from the Oschten-Fischt Group and those from Mt. Guk measure about, alt. 3½, diam. in middle 2 mm., those from the Kurdschips lowlands reach the size of 3¾ x 2⅛ mm.

There is rarely found in the Oschten-Fischt Stock, besides, a uniform greenish-white mut. *albina,* which moreover is distinguished by the pure white lip, not orange-colored. Only 1½ per cent of all the specimens belong to this mutation, which seems confined to the higher, colder stations of those mountains (*Boettger*).

20. LAURIA PULCHRA (Ret.). (Pl. 9, figs. 11, 13, 14, f. *bilabiata*).

Shell ovate-oblong, densely costulate, a little glossy, pale corneous. Spire ovate-conic, the summit shortly conic, suture impressed. Whorls 7½-8, slightly convex, densely obliquely costulate, the last tapering, ascending in front, one-third the length of the shell. Aperture vertical, truncate-semioval, strongly contracted with 5 folds: 1st and 2d on the parietal wall, the latter deeper, the first much stronger, joined to the insertion of the lip by a sinuate callus; 3d and 4th, the last stronger, on the columella; 5th compressed, not erect behind, arising from the base of the outer margin. A long, crest-like tooth in the middle of the right margin, 5 other minute pliciform, obsolete denticles between the 4th and 5th folds. Peristome thickly white-lipped. Length 4, diam. 2 mm. (*Ret.*).

Crimea: Sudak (drift specimens). Tscherkessia, Russian Armenia: Uetsche-Deré (König).

Pupa (Charactrobia) pulchra RETOWSKI, Malak. Bl., n. F., vi, 1883, p. 57 (not pl. 2, f. 13).—*Pupa (Charadrobia) pulchra* RET., Bull. Soc. Imp. Nat. Moscou, Année, 1888 (1889), p. 287.—*Pupa (Charadrobia) pulchra* Ret. f. *bilabiata* RETOWSKI, Malak. Bl. n. F., ix, 1887, p. 35.

It differs from *superstructa* Mouss. by the smaller size with the same number of whorls, the ovate shape and the close costulation of all the whorls. The folds of the aperture are the same except that the fifth [lower-palatal], which in *superstructa* becomes very distinctly higher within, in *pulchra* remains nearly of equal height throughout its length. The plate-like widening of the inner right lateral margin of the aperture (referred to as a tooth in the description, following Mousson's example), projects more strongly in *pulchra* than in *superstructa* (*Ret.*).

The typical *pulchra* has not been figured, and I have not seen it, but except in the less thickened lip it appears not to differ from the following form, which is figured from a specimen out of the Boettger collection.

Lauria pulchra form *bilabiata* (Ret.). Pl. 9, figs. 11, 13, 14. Besides the two specimens from which this species (*pulchra*) was described, I have found a third which is distinguished from them by its smaller size, 3.5 mm. long, with 7 whorls, as well as by having the whitish lip doubled, whilst the first two found have only a simple, thickened lip. The form of the apertural folds and the close costulation remain as in the typical form (*Ret.*).

Crimea, in flotsam on the strand between Theodosia and Sudak (Retowski). Western Caucasus (Boettger coll.).

20*a*. *Lauria pulchra nitens* (Bttgr.). Pl. 9, figs. 12, 15.

Shell larger than the type, uniform chestnut, the whorls more narrowly costulate-striate (not costulate); peristome doubled, the inner lip orange. Length 4 to 4½, diam. 2¼ to 2½ mm. (*Bttg.*).

Woods of the Kurdschips lowland; on Mt. Guk, 3000 ft.; and in the forest zone of the southeastern and northern outliers of the Ochten-Fischt group, Circassia (Leder).

Distinguished from typical examples of var. *bilabiata*, says Boettger, by the gloss of the dark brown shell and the less sharp rib-striation, which is about doubly finer. The specimens from the Oschten-Fischt Stock are smaller than those of the lowlands.

Lauria pulchra (Ret.) var. *nitens* BOETTGER, Nachr.-Bl. D. m. Ges., 1888, p. 152; Ber. Senckenb. Ges., 1889, p. 22.

The minute tubercular basal fold is immersed and towards the left side, not visible in a face view. A topotype out of the Boettger collection, from the Kurdschips lowlands, is figured. Length 4.5, diam. 2.3 mm., 8 whorls.

21. LAURIA PONTICA (Ret.).

Shell ovate, deeply umbilicate, densely costulate, a little glossy, pale corneous. Spire ovate-conic, the summit shortly conic, suture impressed. Whorls 7, a little convex, densely obliquely costulate; the last whorl ascending in front, compressed in the middle at the aperture, keeled beneath, one-third as long as the shell. Aperture vertical, semioval, with 5 folds: 1st and 2d on the parietal, the 2d rather small, median, deeply placed, the 1st lateral, curved, much longer and stronger; 3d lamella long, oblique, median on the columella; 4th basal, short, deeply placed; 5th palatal, long. There is a crest-like or doubled tooth in the middle of the right margin. Peristome subreflected, white-lipped. Length 3.5, diam. 2.2 mm. (*Ret.*).

Asia Minor: Samsun (Retowski).

Pupa (Lauria) pontica Retowski, Bericht Senckenb. nat. Ges., 1889, p. 253.

By the close costulation this remarkable new species recalls the Tscherkessic *P. pulchra* Ret., with which it cannot be confused, being sharply distinguished by various characters. *P. pulchra* is only perforate, the last whorl margined below, without trace of a keel; *P. pontica* has a deep umbilicus, and the last whorl is distinctly keeled below. Moreover, the armature of the mouth is quite different. In *pulchra* there are two folds on the columellar margin, in *pontica* only one, but the latter has a small, deeply placed little fold in the base, opposite the parietal wall, which is wholly wanting in *pulchra*. The plate-like dilation of the inner right margin of the peristome appears to be variable, as in one of my examples it has exactly the form of my specimens of *pulchra,* but in the others has the form of a strong double tooth. Between the spiral [columellar] and the palatal lamellæ the peristome is quite smooth in *P. pontica,* while in *P. pulchra* there are five small fold-like denticles (*Ret.*).

Species of Western Europe.

All belong to the restricted section *Leiostyla.*

22. Lauria anglica (Wood). Pl. 5, figs. 9, 10, 11, 12.

The shell is shortly rimate, lengthened-ovate, chestnut-brown above the periphery, transparent olive-buff below; finely, rather weakly striate. The spire is convexly conic, the summit whitish, obtuse. Whorls somewhat convex, the last ascending slightly close behind the lip, rounded below, compressed within the umbilicus. The aperture is subtriangular, rounded basally. Peristome is pale rufous, narrowly reflected, thickened on the face, the outer lip thickened within, tooth-like, above the middle, excised to form, with the angular lamella, an oval sinulus above; lip-insertions very widely separated. Angular lamella largest, very high, emerging and joined by a callus with the outer lip-insertion. Parietal lamella lower, less emerging. Columellar lamella slanting downward, high, emerging to the peristome. All of these lamellæ enter deeply, the angular and columellar about ¾ of a whorl. Lower-palatal fold triangular, rather long. One small, tubercular basal fold (rarely two).

Length 3.3, diam. 1.8 mm., 6½ whorls.

Length 2.7, diam. 1.7 mm., 6 whorls.

British Is.: throughout the northern counties of England, the west of Scotland, Shetland and Orkney Is. and all Ireland; Guernsey (Jeffreys); also in Pleistocene of Essex and Lancastershire and Holocene of Ireland. Ré Island, Gulf of Gascony. Portugal.

Vertigo anglica FERUSSAC, Tableau Systematique p. 64 (no definition).—TURTON, Manual Land and Freshwater Shells Brit. Is. 1831, p. 102.—LOCARD, Arch. Mus. d'Hist. Nat. Lyon, vii, 1899, p. 154 (Portugal: Cintro and around Porto, *Morelet;* San Felix de Morinho, San Pedro de Coday, Covello, Porto, *Luso;* Bussaco, *Nobre;* Fario, *Castro*).—NOBRE, Mol. de Portugal, p. 239; Annaes Sc. Ac. Polytech. Porto Oporto iii, 1907, p. 56.—*Turbo anglicus* WOOD, Supplement to the Index Testaceologicus, 1828, p. 19, pl. 6, f. 12.—*Pupa anglica* Fer., PFEIFFER, Monographia Hel. Viv. ii, 351; iii, 548; iv, 675; vi, 321; viii, 389.—WESTERLUND, Fauna 1887, p. 82, with forms *globoso-conica*, *cylindracea* and *castanea* and var. *gunhildæ*.—MARGIER, Feuille Jeunes Nat., Année 35, p. 68, fig. (distribution).—*Lauria anglica* CAZIOT, Ann. Soc. Linnéenne de Lyon, N. S., lxii, 1916, p. 62 (distribution etc.).—*Pupa ringens* JEFFREYS, Trans. Linn. Soc. London, xvi, 1829, p. 356; British Conchology, i, 1862, p. 244, with var. *pallida*, p. 245.—*Pupa anglica*. var. alba, COLLIER, Journ. of Conch. ix, 1898, p. 152.

This well-known species has a remarkably discontinuous distribution. The large series examined is from various British localities. I have not been able to compare Portuguese specimens.

Half grown young shells (pl. 5. figs. 11, 12) have 4 or 5 radial barriers in the base, at intervals of about 60 degrees. The lamellæ of parietal and columellar margins are very strongly developed.

According to Locard, there is a *Pupa anglica* Moq.-Tand., Moll. Toulouse, 1843, p. 41, which = *Vertigo desmoulinsiana.*

Various mutations and minor variations have been named, but so far as known, none of them form races.

Mut. *pallida* Jeffreys "shell of a lighter color, sometimes whitish." Mut. *alba* Collier, pure white; Kenmare, County Kerry, Ireland, with the ordinary form.

Form *globoso-conica* West, globose-conic, small, 6 whorls, 2¾—3 x 2 mm. *Cylindracea* West., large, cylindric, 4 x 2 mm. *Castanea* West., chestnut-brown, paler around the umbilicus, peristome flesh-colored. Var. *gunhildæ* West., outer lip very weakly lipped; teeth well developed but without any trace of a callus connecting the long angular lamella and the rather widely separated outer margin. Scarborough mingled with the typical form. J. R. Le B. Tomlin suspects that this is merely an immature stage of *anglica* (J. of Conch. xvi, 1922, p. 264).

23. LAURIA PAULINOI (Locard).

Shell very small, cylindric-ovoid, short; 7 lightly convex whorls, regularly increasing, the last somewhat high, rounded basally; summit obtuse; umbilicus widened, deep, a little oval. Aperture small, somewhat rounded; peristome discontinuous, thick, reflected, the outer margin forming a sinus [sinulus] above, with an inner projection below the sinus; basal margin well rounded; columellar margin nearly straight. Within the aperture there are two superior folds, the first opposite the sinus, attaining the margin of the aperture and strongly developed, the second smaller, more immersed; a fold on the columellar margin almost reaches to the edge of that lip; on the lower margin another similar fold; between the two a little dentiform fold, deeply immersed. Shell thin, reddish brown, paler around the umbilicus, with the peristome and teeth whitish; ornamented with quite strong, close, nearly regular longitudinal striæ. Length 3, diam. 1¾ mm. (*Locard*)

Portugal: Coimbra (collect. Paulino d'Oliveira).

Pupilla paulinoi LOCARD, Archives Mus. d'Hist. Nat. Lyon, vii, 1899, p. 152.

By its umbilicus it approaches *P. umbilicata,* but perfectly characterized by the apertural characters, with 5 denticulations of which three emerge, not permitting a comparison with any of the described forms. At first view this shell has some analogy with *Vertigo anglica,* but the style of umbilicus and form of peristome show it to be a veritable *Pupilla.* (*Loc.*).

Description abbreviated somewhat from Locard. Perhaps it is an umbilicate specimen of *anglica.*

24. LAURIA NUMIDICA (Bgt.). Pl. 5, figs. 13, 14.

This species differs from *anglica,* with which it has been confused, by the less smooth, more strongly striate shell, by the aperture more strongly toothed, and never having a tooth-like fold at the base of the aperture, such as occurs in the lower part of the aperture in all true *anglica.* Moreover, in *anglica* the first lamelliform fold [angular lamella] is always united with the outer margin of the lip by a strong thickening. In *numidica,* on the contrary, this thickening does not exist, and the [angular] fold is perfectly free. Length 3¼, diam. 2 mm. (*Bgt.*).

Algeria: Ain-Tlezid, near Blidah (Morelet); Kabylia at Acherchour-en-Tensaout and Bou Ilef, Tirourda, Ait Daoud and Ait Ouban (Letourneux).

Pupa anglica MORELET, Journ. de Conch. iv, 1853, p. 292. —*Vertigo numidica* BOURGUIGNAT, Malac. de l'Algérie, ii, 1864, p. 100, pl. 6, f. 33-35—HANOTEAU et LETOURNEUX, La Kabylie, i, 1872, p. 228.

The surface is described as obliquely, elegantly very sharply subcostulate. It is a rather solid, subpellucid, glossy, tawny-corneous shell, closely related to *L. anglica* but decidedly narrower. Known to me by Bourguignat's account only.

Letourneux mentioned, but did not describe, a var. *zonata*. Being a nude name, this does not prejudice the use of the same term for a Caucasian species.

Madeiran Species.

Here the Lauriæ have become adapted to both extremely wet and to arid stations, some living on or under rocks, others on plants; and here they have undergone greater structural modification than in any other area. This radiation is partially expressed in the classification into several sections:

Scarabella, for species 25, *L. cassida*.
Leiostyla restricted, for species 26 to 45.
Wollastonula, for species 46, *L. gibba.*
Mastula, for species 47, *L. lamellosa.*

By having an upper-palatal fold in many species the Madeiran forms are more primitive than the *L. anglica* series; but this fold is present also in some other peripheral species in the Azores and Caucasus.

A key to the species may be found on pages 69 to 73.

The literature of Madeiran Pupillidæ is rather extensive, but the publications of Lowe and Wollaston contain nearly all that is original or of value. Wollaston's *Testacea Atlantica,* though without descriptions or figures, is indispensable for its critical notes on these as well as on all other land shells of the Atlantic islands. It has been quoted freely in the following pages.

Very few adequate illustrations of these shells have appeared; those now offered are from specimens out of the Lowe-Wollaston collection, supplemented by others from various sources, some of them from the collection of Mr. J. R. Le B. Tomlin, who gave various rare species and lent others in order that the monograph might be complete. Only *L. degenerata* is wanting in the series at hand.

Titles of the chief publications on Madeiran Pupillidæ follow:

LOWE, RICHARD THOMAS: Primitiæ Faunæ et Floræ Maderæ et Portus Sancti; sive species quædam novæ vel hactenus minus rite cognitæ Animalium et Plantarum in his Insulis degentium breviter descriptæ; in Transactions of the Cambridge Philosophical Society iv, part 1, 1831. Reprinted with a prefatory Address and an Appendix, 1851. Also papers in the Annals and Magazine of Natural History 1852 and the Proceedings of the Zoological Society of London, 1854.

ALBERS, JOHANN CHRIST. Malacographia Maderensis Berlin, 1854.

PAIVA, BARONE DE CASTELLO DE. Monographia Molluscorum terrestrium fluvialium lacustrium Insularum Maderensium, 1867.

PFEIFFER, L. Monographia Heliceorum Viventium. Madeirans in several volumes.

WOLLASTON, T. VERNON. Testacea Atlantica, or the land and freshwater shells of the Azores, Madeiras, Salvages, Canaries, Cape Verdes and Saint Helena. London 1878.

Section *Scarabella* Lowe.

Scarabella LOWE, Ann. Mag. N. H. (2), ix, 1852, p. 277 (in text under *Pupa cassida*); Proc. Zool. Soc. 1854, p. 212, Monotypic for *P. cassida*.

Solid; ovate, the whole spire tapering conically, of nearly flat whorls; umbilical area small. The aperture has numerous teeth, all of them emerging to the peristome; the angular, parietal and columellar lamellæ and lower-palatal fold enter deeply.

By the shape of the aperture and spire the single species of this section has some resemblance to *L. cheilogona;* in teeth it is more like *cassidula*. Though strongly differentiated, *Scarabella* probably arose from the ancestral stock of these Leiostylas. By having callus within the outer and basal margins of the lip it resembles *L. calathiscus*, which is otherwise quite different.

25. LAURIA CASSIDA (Lowe). Pl. 14. fig. 1.

The shell is ovate-conic, compact, solid; perforate, with a very small umbilical excavation; surface with little gloss, regularly rib-striate, the base very finely striate; buff, more or less mottled with brown above, and with the base dark brown, generally with a lighter band. The slowly increasing whorls are nearly flat, the last short, rounded basally. The aperture is subtriangular, with 8 (or 9) teeth, all emerging at least to the inner edge of the peristome. The two lamellæ of the parietal wall, the columellar and the lower-palatal, enter deeply. Angular lamella united by a callus with the lip-insertion. Parietal lamella smaller, emerging. Columellar lamella strong, horizontal, a small supracolumellar above it. Lower-palatal fold strong, long, a short upper-palatal fold between it and the strong lip-tooth bounding the sinulus, these two more or less confluent. Near the upper insertion of the lip there is often a quite small tooth. Basal tooth short. The peristome is expanded, the lower and columellar margins reflected, calloused within. Columellar margin very oblique, curved inward.

Length 4.6. diam. 2.8 mm.; 8 whorls.

Length 4, diam. 2.7 mm.; 7 whorls.

Madeira: extreme head of the Ribeira de Sta. Luzia (type loc.) among vegetable detritus, on the steep butress or bank immediately to the right of the waterfall, and which constitutes the base of the lofty, perpendicular rocks; also in northern Madeira in the Ribeira de Sao Jorge. Common in the Pleistocene at Canical (Wollaston).

Helix C. cassida LOWE, Cambr. Philos. Trans. iv, 1831, p. 64.—*Pupa cassida* LOWE, Proc. Zool. Soc. Lond. 1854, p. 212. PFR., Monogr. ii, 344. — ALBERS, Malac. Mader., p. 68.— WOLLASTON, Test. Atl. p. 213.

The large size, conic spire and numerous submarginal white teeth, the close costulation and mottled coloring of the solid, compact shell, will readily distinguish *cassida* from other species.

It is rather rare as a recent shell, and I have not seen any young specimens, the teeth in that stage being therefore unknown. Wollaston believes that it will prove to be pretty generally distributed in the damp, sylvan ravines of intermediate altitudes.

Section *Leiostyla* proper.

In the Madeira Islands this section begins with species resembling those of western Europe, of the European Tertiary and the less specialized Caucasians; but by easy stages the shape becomes more cylindric, the sculpture stronger, and accessory teeth develop. These tendencies culminate in the *L. ferraria* group of species (*Craticula* of Lowe), mainly inhabiting dry stations. On Porto Santo this cylindric, ribbed, many-toothed line has its fullest expression.

26. Lauria cheilogona (Lowe). Pl. 10, figs. 3, 4, 5.

The shell is thin, perforate, rimate, with small, deep umbilical region; ovate-conic, sides moderately convex; apex obtuse, perfect or but slightly worn. Its surface shining but not glossy, very weakly, irregularly striate, chiefly near the suture; of a dilute, transparent isabella color, with a transparent brown peripheral band. Whorls are slightly convex, the last slowly ascending in front, compressed laterally, the base being somewhat pinched and narrowly rounded below; umbilicus with a deep spiral groove. Aperture 4-plicate, produced towards the outer-basal margin. Angular lamella widely removed from the lip-insertion, thin, high, penetrating inward fully a half whorl, irregularly serrate within. Parietal lamella smaller, shorter. Columellar lamella thin, broad, sloping downward. Palatal fold low, tapering slowly to both ends, more than 1/3 of a whorl long. The peristome is narrowly reflected, its inner edge thickened a little, bearing a blunt tooth above, defining the sinulus. Length 4.1, diam. 2 mm.; 6¾ whorls.

Madeira: in damp, sylvan districts, chiefly toward the north, at high elevations: Lombarda das Vacas, Montado dos Pecegueiros etc., on fronds of ferns (Wollaston and Lowe). Near Sao Vincente (Albers).

Helix C. cheilogona Lowe, Primitiæ, 1831, p. 63, pl. 6, f. 31.—*Pupa cheilogona* Lowe, Pfr., Monogr. ii, 327; iv, 675.—Albers, Malac. Mader. p. 63. — Paiva, Monogr. p. 122.—Wollaston, Test. Atl. p. 213.

The spire is more straightly conic than in *L. vincta, L. v. watsoniana* or *L. concinna.* The absence of a supracolumellar lamella distinguishes it from *L. irrigua, L. loweana* and others.

In the juvenile stage there are at first 3, later 2 radial basal folds, rather close together. The angular and columellar lamellæ are very large, the parietal very small.

27. LAURIA VINCTA (Lowe). Pl. 10, figs. 8, 9, 10, 11.

" Differs from *cheilogona* Lowe by the smaller size, shorter, more obese shape, the apex more obtuse, aperture rounded-oval, not ear-shaped, the shell smoother, more glossy, brighter colored, banded; by the larger ventral [parietal] folds, etc. Near to *P. irrigua* but surely distinct " (*Lowe*).

The angular and parietal lamellæ are higher (that is, project further into the aperture) than in *L. cheilogona,* but they are *shorter*, reaching inward only to a dorsal position, where they diminish rapidly; the crest of the angular lamella is not serrate. The lower-palatal fold is low, as in *L. cheilogona,* but it is shorter. The base of the shell is rounded, not pinched laterally, and there is only a very slight spiral groove within the umbilicus. There is no upper-palatal fold, but a minute subcolumellar may generally be seen inward from the baso-columellar junction. The apex is generally decorticated.

Length 3.5, diam. 2 mm.; 5¾ whorls.

Length 3, diam. 1.9 mm.; 5½ whorls.

Madeira: chiefly in the north, on dripping masses of *Marchantia polymorpha* which pad the rocks at a low elevation, especially at shore level; first waterfall from Sao Vincente, along the beach road to Seisal, and Passa d'Areia (Lowe and Wollaston).

Pupa vincta LOWE, Ann. Mag. N. H. (2), ix, 1852, p. 276. —ALBERS, Malac. Mader. p. 63.—PFR., Monogr. iii, 549; iv, 675; vi, 321.—WOLLASTON, Test. Atl. p. 214.

Besides the differential characters given above, it may be mentioned that this species is more glossy than *L. cheilogona,* less striate, usually more olivaceous and frequently more distinctly banded. The shape of the aperture is characteristic, and it has about a whorl less.

Young shells show 2 to 5 radial folds in the base of the last half whorl (pl. 10, figs. 9, 11).

27*a*. *L. vincta watsoniana* n. subsp. Pl. 10, figs. 6. 7.

Much larger than *L. vincta,* less conic, the outlines of the spire being more convex; summit decorticated. Lamellæ as in *vincta,* but there is a larger though still small sub-colummellar fold inward from the baso-columellar junction.

Length 4.4, diam. 2.25 mm.; 6 whorls.

Length 4.3, diam. 2.25 mm.

This form is evidently what Wollaston alludes to as being the largest Madeiran Pupa, with the exception of *P. cassida.* He notes also that *vincta* has a larger and a smaller state.

28. LAURIA IRRIGUA (Lowe). Pl. 10, figs. 12.

The shell is minutely perforate, rimate, cylindric-tapering with obtuse, generally worn summit, subtranslucent isabella color, sometimes indistinctly banded; rather glossy, finely striate below the suture, elsewhere smoothish. The whorls are very slightly convex, the last a little swollen behind the outer-basal margin of lip, and slightly concave behind the columellar lip. Aperture is squarish with rounded base, 7-plicate. Angular lamella very high, somewhat sinuous, penetrating to the back, joined to the lip-insertion by a strong callus; often denticulate on the right side within the sinulus. Parietal lamella smaller and shorter. Columellar lamella wide, sloping downward, a smaller, short supra-columellar lamella above it. Lower-palatal fold well developed. A very small upper-palatal is weakly connected with an inward continuation of the tooth on the outer lip bounding the sinulus, the whole parallel to the crest of the angular lamella. A small basal fold stands inward from the baso-columellar margin. Peristome brownish, expanded and very little reflected.

Length 4.2, diam. 2.1 mm.; 6¾ whorls.

Madeira: mainly in the south, in muddy *Marchantia*-padded deposits of the damp, trickling rocks, in shady ravines of intermediate altitudes, also on the wiry roots of coarse grasses in the constant drip of such places; on perpendicular face of lofty rocks on the eastern side of the Ribeira de Sta. Luzia, about two-thirds of the way up to the waterfall. Also apparently taken by Paiva in northern Madeira (*Wollaston*).

Pupa irrigua Lowe, Ann. Mag. N. H. (2), ix, 1852, p. 276; P. Z. S. 1854, p. 208.—Albers, Malac. Mader. p. 63.—Paiva, Monogr. p. 124.—Pfr., Monogr. iii, 549.—Wollaston, Test. Atl. p. 215.

A rather large *oblong* species, resembling *L. v. watsoniana* in shape; like that it is often decorticated at the summit. It differs from all forms of *vincta* by the strong callus connecting the angular lamella with the lip-insertion, by the presence of a supra-columellar lamella, and of a small upper-palatal fold. The small basal fold is very deeply immersed.

The species *irrigua, loweana, transiens, cassidula* form a nearly connected series, the successive members discriminated by small differences of sculpture and contour. *L. loweana* stands extremely close to the present species, but *L. irrigua* is a little narrower and *decidedly smoother* than *loweana*.

The radial folds of the young seem to be retained into late youth. A specimen of 6 whorls shows 5, and there were probably more, as the last part of the base is broken away.

29. Lauria loweana (Wollaston). Pl. 10, figs. 13, 14.

The shell is oblong-ovate, rather densely striatulate, somewhat shining, dark umber-brown (generally more or less whitish, decorticated, towards the apex), sometimes obscurely banded, whorls slightly convex, suture impressed. Aperture ear-shaped, ringent, the angles rounded, 5-plicate; there being 2 ventral folds, the outer larger, 2 columellars, the lower larger, 1 palatal; the outer ventral and lower columellar of about equal size, upper columellar and palatal smaller, immersed, somewhat inconspicuous. Outer lip somewhat thickened, a little reflected, with an inwardly projecting tooth defining the sinus; sinus (between the angle and ventral fold) surrounded with a thick corneous sphincter. Length 1¾—2 lines (*Wollaston*).

Generally similar to *L. irrigua*, but darker, *more striate*, often of shorter figure. *The supracolumellar lamella is longer,* penetrating *as far as can be seen* in the aperture. There is sometimes a small basal fold but usually none. A small, immersed subcolumellar fold is present. An upper-palatal fold is wanting, or sometimes represented by a mere trace, and the lip-tooth limiting the sinulus is generally slender. As in *irrigua*, there is a strong callous ridge connecting angular lamella and lip-insertion.

Length 4.35, diam. 2.05 mm.; 7 whorls.

Length 3.7, diam. 2 mm.; 6½ whorls.

Length 3.2, diam. 1.9 mm.; 6½ whorls.

Madeira: especially northward, believed to be chiefly from the Boa Ventura and the Ribeira do Inferno (Paiva's collector).

Pupa wollastoni LOWE, Ann. Mag. N. H. (3), xix, Feb., 1867, p. 81. Not of Paiva, 1866.—*Pupa deformis* WOLLASTON, Test. Atlant., 1878, p. 216.—*Pupa concinna* Lowe, PAIVA in coll., and Mon. Moll. Mader. 1867, p. 127, in part. Not of Lowe.—*Pupa loweana* WOLLASTON, Test. Atlant., 1878, p. 217, with var. *transiens*.

It stands close to the south Madeiran *L. irrigua*, as noted above. Wollaston found it mixed with lots of *L. vincta* received from the Baron de Paiva, and concluded that it lives in the drip of *Marchantia*-padded rocks at a low elevation.

Pupa wollastoni Lowe, renamed *P. deformis* Woll., was based upon a single specimen picked out of a lot of *loweana* and *vincta*. It is evidently an abnormal shell, in which the spire has been somewhat " telescoped ", leaving a projecting flange below the suture, an unusual but well-known teratologic condition. Wollaston evidently had doubts of its validity. As two specific names have been applied to this specimen, Lowe's account is here given.

Pupa wollastoni—The shell is rather large, somewhat solid, compact, short, broadly short-oblong, obtuse at both ends, the width subequal in the last 2-2½ whorls, forming ⅔-⅚ of the length, then the rest of the whorls suddenly contracting in a slightly projecting umbonate apex, all obsoletely striatulate, smooth, shining; dark brown (the spire decorticated and white towards the apex), very narrowly 1 to 2 banded with paler color. Whorls 6, flattened or a little convex, (the last 2 or 3 abruptly swollen and projecting below the somewhat channeled suture, the last whorl anteriorly more distinctly concave in the middle, or lightly spirally subcanaliculate preceding the labrum, traversed by somewhat fluxuously oblique obsolete striolæ, the impressed suture deeply cut. Aperture subtrilobate-auriform or triangular, the angles rounded, ringent, 5-plicate; 2 ventral folds, the exterior larger, 2 columellar, the lower one larger, 1 palatal; two centrals and the lower columellar subequal, large, the upper columellar and palatal smaller, less conspicuous, immersed; outer lip somewhat thickened, a little reflected, inflected above, a distinct tooth projecting inward at the sinus; respiratory sinus nearly entire. Length 3, diam. 2½, aperture 1 mm. long, 1 wide; 6 whorls. (*Lowe*).

"At once distinguished from *P. concinna* Lowe by its much greater proportionate breadth and short, thick squarish figure; and from *P. gibba* and *P. abbreviata*, besides other differences, by its being so much larger. There is also much about it which reminds one of *P. cassida* and *P. cassidula*, but it is most distinct from all, especially by the abrupt contraction of the spire about the last two or three volutions, and by the scalariform character of these, each rising up into a blunt keel or ridge below the deeply impressed or subcanaliculated suture. The colour also is peculiar, being more of a dark umber than chestnut brown, with two remote, narrow pale bands, one at the base, the other on the infrasutural ridge or shoulder at the top of the last volution, but these will probably prove variable and even in the present example the upper band is obscure and inconspicuous. The spire is abruptly contracted above the second or third volution into a short obtuse decorticated umbo; the lowest two or three volutions are of nearly equal breadth, or broadly and shortly barrel-shaped, and the last is spirally concave or slightly grooved or channeled a little way backward from the outer lip below the middle. The aperture, both in shape and in the form, size and proportion of its plaits, differs from that of all the species, above mentioned. The umbilicus is moderately large and infundibuliform.

A unique example of this fine new Pupa, with the remains of its animal still present in the aperture, was detected by T. Vernon Wollaston, Esq., the well-known explorer of the Atlantic insect fauna and author of ' Insecta Maderensia ' Canariensia, etc., in a box containing a number of specimens of *P. concinna* Lowe, sent to him from Madeira, about a year ago by the Baron do Castello de Paiva, and marked ' Rib. do Inferno ' ''.

29*a*. *L. loweana transiens* (Woll.). Pl. 11, figs. 1, 2.

A little smaller, somewhat more strongly and not so closely striate; shell generally somewhat paler and a little less solid; sometimes subpellucid, conspicuously paler, or banded (*Wollaston*). There is a small upper-palatal fold.

Length 3.6, diam. 1.85 mm.; 6½ whorls.

Length 3.2, diam. 1.8 mm.; 6½ whorls.

The special locality of this form was not noted. Taken only by Paiva's collector. It differs very little from *L. cassidula.*

30. LAURIA CASSIDULA (Lowe). Pl. 11, fig. 3.

The shell is perforate and rimate, ovate, stout, chamois to cream-buff. Surface scarcely shining, closely, strongly striate, the striæ irregular and partly obsolete on the last whorl, which is slightly glossy. Outlines of spire are strongly convex. The aperture is truncate-oval, 7-plicate. The high, thin, angular lamella emerges beyond the lip-insertion, with which it connects by an elevated lamina. Parietal lamella well developed. Columellar lamella slanting downward as usual, a small but deeply entering supracolumellar above it. Lower-palatal fold high and strong, entering to the dorsal side; above it a short but well developed upper-palatal fold. There is also a very deeply immersed but well developed subcolumellar fold. The lip is expanded, slightly reflected, bearing a stout tooth above, defining the short, squarish sinulus. Length 3.2, diam. 1.8 mm.; 6½ whorls.

Madeira: Ribeira de Sta. Luzia at a rather high elevation, at the foot of lofty, perpendicular rocks, amongst vegetable debris (Wollaston, Armitage, Watson); very rare.

Pupa cassidula Lowe, Ann. Mag. N. H. (2), ix, 1852, p. 277.—Kuester, *Conchyl. Cab.* p. 167, pl. 20, f. 12, 13.—Albers, Malac. Mader. p. 68, pl. 16, f. 9, 10.—Paiva Monogr. p. 136.—Pfr., Monogr. iii, 553; vi, 323.—Wollaston, Test. Atl. p. 218.

This form, figured from a specimen from the Lowe-Wollaston collection, stands very close to *L. loweana transiens*. In *L. cassidula* the upper-palatal fold is decidedly better developed, the whorls of *cassidula* are perhaps a little shorter and the form thus more compact. The aperture is shorter. *L. l. transiens* is supposed to be from northern Madeira, while this species is from the south. Wollaston states that *cassidula* " is paler and a little more coarsely striated [than *L. loweana transiens*]; and the lateral denticle of its outer lip is somewhat more prominent internally, causing the sinus to be less open, or more narrowly closed in behind."

31. Lauria concinna (Lowe). Pl. 11, figs. 4, 5, 6.

The shell is perforate and rimate, cylindric, with short, convexly-conic, obtuse summit, chestnut-brown, with the base and a narrow band on the upper surface olive-buff. Surface slightly shining, very closely and finely but strongly striate, the striation weak on the last whorl, which is smoothish at the periphery and beneath. Whorls but slightly convex. Aperture 5-plicate. Angular lamella very high, oblique, *flaring outward* nearly to the tooth of the outer lip, *not connected with the lip-insertion.* Parietal lamella also flaring outward. Columellar lamella strong, emerging, horizontal. Lower-palatal fold strongly developed, immersed, laterodorsal. No upper-palatal fold. Subcolumellar lamella low, tubercular, so *deeply immersed* that it is only partially seen in an oblique view in the mouth. Peristome brownish, narrowly expanded and a little thickened, bearing a narrow but well developed tooth above.

Length 3.7, diam. 1.7 mm.; 7½ whorls.

Length 3.25, diam. 1.75 mm.; 6½ whorls.

Madeira: in the highest elevations, on broken sticks and small stones near the minute, trickling streams, as well as beneath damp moss; extreme head of the Ribeira de Joao Delgada and found later on the north side of the Pico Casado, at the head of the Boa Ventura (Lowe and Wollaston).

Pupa concinna Lowe, Ann. Mag. N. H. (2), ix, 1852, p. 277.—Kuester, Conchyl. Cab. p. 181, pl. 21, f. 24. 25.—Albers, Malac. Mader. p. 65, pl. 16, f. 11, 12.—Pfr., Monogr. iii, 544; vi, 310.—Wollaston, Test. Atl. p. 219.

This species is nearest to *L. laurinea* in shape and armature of the aperture, but there is no callus between angular lamella and lip-insertion, and the fine striation is entirely different. Wollaston writes: " It is darker as well as more densely and coarsely striated than that species [*laurinea*], and its two ventral plaits [*lamellæ of parietal wall*] are more flexuose and oblique, or less vertical (causing the sinus to be even still more closed in), the external one [angular lamella] being also more completely unconnected by even a rudimentary callosity with the angle of the lip." *L. concinna* differs from *L. loweana* and *cassidula* by the more narrowly cylindric form, by the absence of a supra-columellar lamella etc.

A specimen about half grown has 6 radial basal folds (pl. 11, fig. 5). One of the full-grown shells retains a single radial fold within the base on the left side.

32. Lauria laurinea (Lowe). Pl. 11, figs. 8. 9.

The shell is oblong-cylindric, olivaceous-buff, with a chestnut band median on the last whorl, another below the suture. Surface somewhat glossy, most minutely striate on the spire, the last whorl smoothish, whorls slightly convex, the last compressed below, narrowly rounded at base. The aperture is truncate-oval, 5-plicate. Angular lamella very high and thin, oblique, flaring outward, more or less fully connected with the lip-insertion by an uneven or interrupted callus. Parietal lamella small, also oblique. Columellar lamella horizontal, no supracolumellar. Subcolumellar very small, immersed. Lower-palatal fold rather immersed, high. Peristome a little reflected, brownish, bearing a tooth above.

Length 3.4, diam. 1.7 mm. nearly 7 whorls.
Length 3.2, diam. 1.7 mm. 6½ whorls.

Madeira: chiefly about the trunks of old laurels in the wooded districts of intermediate elevations; Ribeiro Frio, S. Antonio da Serra and the Boa Ventura. Also Pleistocene at Canical (Wollaston).

Pupa laurinea Lowe, Ann. Mag. N. H. (2) ix, 1852, p. 276. —Albers, Malac. Mader. p. 64, pl. 15, f. 31, 32.—Pfr., Monogr. ii, 543; vi. 309.—Wollaston, Test. Atl. p. 220.

It is much smoother than *L. concinna*, the striation being very fine; the color is lighter; there is more or less callus between angular lamella and lip-insertion, but this callus is sometimes interrupted in the middle; finally, the sinulus is somewhat more open below. The lamellæ and folds are otherwise nearly similar.

In quite young shells of 3-3½ whorls there are two radial basal folds. In those two-thirds grown there may be 4 or 5 in the last half whorl.

33. Lauria sphinctostoma (Lowe). Pl. 11, figs. 10, 11, 12.

The shell is slowly tapering subcylindric, in the upper third tapering convexly to the blunt apex; brown, with the base and a narrow band in the middle of upper surface pale. Surface somewhat shining, strongly striate, this sculpture disappearing more or less on the last whorl and absent from the first 1½. The whorls are slightly convex, the last a little compressed towards the base, excavated behind the columellar lip. Aperture 6-plicate. The very high angular lamella is branched above, curving into the outer lip. The strong emerging columellar lamella slants downward. Supracolumellar lamella small, less emerging, entering deeply. The angular, parietal, columellar and supracolumellar lamellæ are about equally long, penetrating inward nearly to a dorsal position (pl. 11, fig. 12). Lower-palatal fold strong, somewhat immersed, entering to the dorsal side. Upper-palatal represented by a very weak callus running inward and downward from the strong tooth of the outer lip. Basal fold well developed, somewhat immersed. No subcolumellar

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lamella. The peristome is brown, thin, expanded and somewhat reflected. Length 3.6, diam. 1.5 mm.; 7½ whorls.

Madeira: chiefly in the north and towards the coast, at rather low elevation, about the roots and dead leaves of *Sepervivum tabulæforme* and a few other plants which stud the faces of exposed rocks (Wollaston).

Helix C. sphinctostoma Lowe, Primitiæ, p. 63.—*Pupa sphinctostoma* Pfr., Monogr. ii, 335; iii, 543; iv, 569; vi, 309.—Lowe, P. Z. S. 1854, p. 209, with var. *rupestris* and *arborea*.—Albers, Malac. Mader. p. 64.—Wollaston, Test. Atlant. p. 222.

For comparisons see under *L. lævigata* and *wollastoni*. *L. sphinctostoma* in the wide sense is a highly variable species, the name covering numerous forms and races which can be fully worked out only when sufficient accurately localized material is in hand.

Lowe distinguished two varieties: "*rupestris*, the spire more distinctly striate," and "*arborea*, the shell smoother, more glossy and more obsoletely striatulate." The first of these is what he had at first figured as *sphinctostoma*, and the name *rupestris* is therefore superfluous and yields to *sphinctostoma*. No definite localities were given for either variety. The figures of *sphinctostoma* and *arborea* here given are from specimens out of the Lowe-Wollaston collection, not exactly localized, but serving to fix the identity of the two forms.

In a specimen from Machico (T. D. A. and W. Cockerell) the striation is finer than typical. Supracolumellar lamella very weak, basal fold minute, tubercular; lower-palatal small. There are no subcolumellar or upper-palatal folds.

Another specimen, locality unknown, has also very delicate striation and reduced teeth, the supracolumellar and lower-palatal weak, basal, upper-palatal and subcolumellar wanting.

33*a*. Lauria sphinctostoma arborea (Lowe). Pl. 11, figs. 13 to 16.

The shell is more straightly cylindric than *L. sphinctostoma*, paler, olive-buff, uniform or banded with brown at periphery and above suture; finely, weakly and *very lightly* striate.

It has angular, parietal, columellar and supracolumellar lamellæ, as in *sphinctostoma,* but there is also, in typical *arborea,* a very small, immersed subcolumellar. Lower-palatal fold flat-topped, a distinct but short upper-palatal between it and the lip tooth. Basal fold well developed. Apex generally more or less worn.

Length 4.1, diam. 1.7 mm.; 8 whorls.

Length 4.4, diam. 1.5 mm.; 7¾ whorls.

Length 3.4 mm.

Madeira: at higher elevations than *sphinctostoma,* in woods, in moss and under the loose bark of laurels; abundant at the Ribeiro Frio, at S. Antonio da Serra, in the Ribeira de Santa Luzia, and indeed throughout the wooded districts generally (Wollaston).

In a series from Santa Cruz (M. Grabham) the shell is more striate above than in typical *arborea,* the upper palatal fold is obsolete or very small, and there is no subcolumellar. An immature one of this lot having 6⅓ whorls shows 6 evenly spaced radial folds within the base (pl. 11, fig. 14).

L. sphinctostoma heterodon n. subsp. Pl. 11, fig. 7.

Striate as in *sphinctostoma,* brownish with an olive-buff band. Supra and infracolumellar lamellæ and upper palatal fold are wanting. The angular lamella has no denticle opposite the lip-tooth. Length 3.5, diam. 1.5 mm.; 7¾ whorls. Type 130428 A N S P.

L. sphinctostoma simulator n. subsp. Pl. 12, fig. 11.

The shell is finely striate on the spire, as in *L. s. arborea;* dilute chestnut, with the base and a median spiral band on the whorls very pale greenish. Angular, parietal and columellar lamellæ smaller than in *arborea* or *sphinctostoma,* the parietal not penetrating so deeply; the lower-palatal fold is rather short, moderately high, its summit narrow, rounded (not enlarged or flattened). No basal or upper palatal folds are present; supracolumellar lamella only weakly indicated. Length 3.7, diam. 1.5 mm.; 7⅓ whorls. Type 5611 A N S P.

This form resembles *L. laevigata,* but differs by the strong connecting callus between angular lamella and lip-insertion, and the decidedly larger and longer parietal lamella; this however is much shorter than in *sphinctostoma,* in which the parietal penetrates as deeply as the angular lamella, as seen in pl. 11, fig. 12.

34. LAURIA WOLLASTONI (Paiva). Pl. 13, figs. 1, 2, 3.

The shell is cylindric, whitish gray with brown bands at suture, periphery and base of last whorl, sharply and very finely striate on the spire, the last whorl smoother. The whorls are moderately convex, the last whorl tapering downwards, having a spiral impression corresponding to the lower-palatal fold. The folds are visible as white lines externally in well preserved examples.

Aperture auriform, 9-toothed. Angular lamella large, strongly connected with the lip-insertion; parietal lamella almost equally large but somewhat immersed. Columellar lamella strong, slanting downward, a small supracolumellar above it. In the outer lip there is a small tubercle close to the insertion, an acute, emerging tooth defining the sinulus, a small, short, immersed upper-palatal below it, followed by the rather large but immersed lower-palatal fold. In the base there is a well developed but immersed fold. The peristome is reflected, slightly thickened within.

Length 2.5, diam. 1.2 mm.; 6½ whorls.

Madeira: Pleistocene at Canical.

Pupa wollsatoni [err. typ. for *wollastoni*] PAIVA, Journ. de Conchyl. 1866, p. 339, pl. 11, f. 2.—*Pupa canicalensis* PAIVA Mon. Moll. Mader., 1867, p. 131, pl. 2, f. 8 (new name for *P. wollastoni*).—*Pupa wollastoni* Paiva, WOLLASTON, Test. Atl. p. 221.

It resembles *L. sphinctostoma arborea* in the teeth, but the lower-palatal fold is not so flattened. The shell is much smaller and more sharply striate. Though found fossil, it often retains the colored bands. Besides some small differences in the teeth, it differs from *L. sphinctostoma* by the small size and finer sculpture.

Paiva renamed this species when under the erroneous impression that the name first given was preoccupied.

35. LAURIA LAEVIGATA (Lowe). Pl. 13, figs. 4. 5.

The shell is cylindric, slowly tapering above, the summit rounded, obtuse; thin; subtransparent light brownish olive. Surface shining; upper half very finely but sharply striate, the last whorl nearly smooth. Aperture ear-shaped, 4-plicate and with the usual lip tooth. Angular lamella thin, not connected with the lip-insertion, penetrating inward nearly to the ventral side. Parietal lamella small and *very short*, not entering. Columellar lamella small, horizontal, entering to the left side. Lower-palatal fold running to the dorsal side, rising in a median point. Lip narrowly expanded, slightly reflected, bluntly toothed above. Sinulus rather widely open below.

Length 4.1, diam. 1.6 mm.; 7½ whorls.

Length 3.6, diam. 1.55 mm.; 7¼ whorls.

Madeira: in the southern part near the head of the Ribeira de Sta. Luzia, under the dead and loosened bark of old laurel trunks (Wollaston).

Pupa laevigata LOWE, Ann. Mag. N. H. (2), ix, 1852, p. 276.—ALBERS, Malac. Mader. p. 65.—PFR., Monogr. iii, 544.

With much the general form of *L. sphinctostoma* and *arborea,* this species differs conspicuously by the simpler aperture. There is no callus connecting angular lamella and lip-insertion, and deep within small points arm the free edge of the angular (not always so well developed as in fig. 5—an obliquely basal view). The *parietal lamella is very short,* the columellar lamella is low, and no basal fold is present. It is thus very distinct. The striation mentioned in the description is sometimes rather weakly developed.

The immature shell has radial folds in the base arranged as in *sphinctostoma,* but they are very small and short, three or four being developed in the later stages of youth. No parietal lamella was seen in any of 8 young shells examined, from small to large.

36. LAURIA RECTA (Lowe). Pl. 13, figs. 6, 7, 8.

The shell is long, cylindric, banded with chestnut brown on a slightly paler, more olive ground, rather opaque. Surface lusterless, very closely and minutely, weakly striate. Whorls at first convex, then somewhat flattened. Angular lamella thin, straight and oblique, connected by a high callous ridge wth the lip-insertion, penetrating to the dorsal side. Parietal lamella not penetrating quite so far. Columellar lamella rather strong, horizontal; the weak trace of a supracolumellar above it. The upper-palatal fold is not very long. Basal fold smaller or quite small. Only the angular lamella emerges to the peristome. The peristome is narrowly expanded, a little reflected, brown, bearing a small tooth above.

Length 5, diam. 1.5 mm.; 7½ whorls.

Length 4.7, diam. 1.5 mm.; 7½ whorls.

Madeira: around roots and among dry leaves of *Sempervivum tabulæforme* growing on rocks, particularly towards the coast; sea cliffs below Sao Vicente and towards the Ribeira da Janella, and along the whole north shore (Wollaston).

Pupa recta LOWE, Ann. Mag. N. H. (2), ix, 1852, p. 276; P. Z. S. 1854, p. 210.—PFR., Monogr. iii, 543; vi, 309.—KUESTER, Conchyl. Cab. p. 168, pl. 20, f. 16, 17.—WOLLASTON Test. Atlant. p. 224.

It is a more elongate, duller shell than *L. lævigata*, with the parietal lamella larger, and having a conspicuous callus between angular lamella and lip-insertion.

Lauria recta macilenta (Lowe). Pl. 13, fig. 9.

Differs from *L. recta* "in being somewhat smaller, paler, thinner and just appreciably more distinctly striate, in its ultimate volution being a trifle shorter, and in its two palatal plaits being greatly reduced in dimensions" (*Wollaston*). The basal fold is small or very small, and deep within; upper-palatal fold from small to rather long in different examples. Length 3.7, diam. 1.4 mm.; 7½ whorls.

Madeira group: Deserta Grande, in crevices and hollows of the red volcanic soil on the great western promontory known as the Pedragal (Wollaston).

Pupa macilenta LOWE, Ann. Mag. (2), ix, 1852, p. 276.—WOLLASTON, Test. Atl. p. 225.

Group of *L. ferraria* (*Craticula* Lowe).

Craticula LOWE, Ann. Mag. N. H. (2), ix, 1852, p. 277, for *P. fusca, millegrana, ferraria;* P. Z. S. 1854, p. 211, "typ. *P. substriata* Jeffr." — v. MARTENS, Die Heliceen, 1860, p. 295, "Typus *P. calathiscus* Lowe."—*Eryma* ALBERS, Malac. Mader. 1854, p. 67, for *P. calathiscus* (here designated type), *P. cassida, P. cassidula, P. gibba.*

Cylindric, ribbed or costulate forms with strongly convex whorls (except *L. abbreviata*), the aperture as in *Leiostyla* proper. The first three species are from Madeira, the rest from Porto Santo. Type of *Craticula* is *L. ferraria* Lowe.

Lowe formed a section for part of these species, but the group is connected so closely with species immediately preceding that a separate designation is scarcely needed. Lowe and von Martens subsequently, nominated type-species for *Craticula* which were not mentioned in the original proposition of the group, therefore not available. The note on *Craticula* in vol. xxvi, p. 233 should be deleted; the writer was misled by Lowe's unlawful type designation.

This group includes all of the Lauriæ of Porto Santo and a few species of Madeira.

37. LAURIA FUSCA (Lowe). Pl. 13, figs. 10, 11.

The shell is cylindric with blunt, rounded summit, tawny or somewhat olivaceous pale brown with a chestnut-brown band, faint or distinct. Surface rather shining when clean, with close sculpture of regular striæ (fine costulæ), which are but slightly oblique, either a little weaker or coarser on the last whorl; about 18 riblets in one mm. on the last whorl near suture. The whorls are rather strongly convex. Angular lamella is weakly denticulate on the right side, opposite the lip-tooth, and is bifid anteriorly, giving off a strong callous ridge to the lip-insertion. Parietal lamella nearly as high as the angular, long. Columellar lamella is strong, slants downward, and emerges to the peristome. There is a small but distinct and deeply entering supracolumellar. The lower-palatal fold is long, strong and emerging. The lip-tooth is continuous inwardly with a short upper palatal fold. Basal fold well developed and but little immersed. Peristome brown, narrowly expanded, slightly reflected.

Length 3.25, diam, 1.4 mm.; 7 whorls.

Length 3.2, diam. 1.3 mm.; 7 whorls.

Madeira: chiefly in the north and west; under dry leaves of *Sempervivum tabulæforme* on rocks, like *L. recta;* along the whole coast below Sao Vicente, Ribeira da Janella and Porto Moniz, as well as near Feyaa d' Ovelha and Ponta de Pargo (Wollaston).

Pupa fusca Lowe, Ann. Mag. N. H. (2) ix, 1852, p. 277. —Kuester, Conchyl. Cab. p. 169, pl. 20, f. 21, 22.—Pfr., Monogr. iii, 558.—Albers, Malac. Mader. p. 66, pl. 15, f. 37, 38.—Wollaston, Test. Atl. p. 226.

Smaller than *L. recta* and *macilenta*, with a distinct supracolumellar lamella, the whorls more convex, and the striation less oblique, more regular and relatively stronger.

The sculpture of the last whorl varies; the riblets may become more spaced but less regularly on the last whorl; in one specimen 10 may be counted in 1 mm. on the face. In others the sculpture is weaker and not much coarser on the last whorl, 18 riblets in 1 mm.; on earlier whorls it varies less. The first 1½ whorls are smooth.

An immature specimen shows 3 strongly developed radial folds in the base of the last quarter turn.

38. Lauria millegrana (Lowe). Pl. 13, figs. 12 to 15.

The shell is cylindric with obtuse, rounded summit, brown, dull. Surface finely costulate, the riblets a little narrower than the intervals. The whorls are rather strongly convex. Aperture much *obstructed* by 7 lamellæ, folds and teeth. The angular lamella is strong, somewhat sinuous, united by a callus with the lip-insertion. Parietal lamella about as high as the angular, stout, not emerging. Columellar lamella is stout, slants downward, and does not emerge to the peristome. A small, less emerging supracolumellar present. The lower-palatal fold is very stout, its edge broad, but it is rather short; above it is a strong, short upper-palatal fold, midway between lower-palatal and the lip-tooth. Basal fold stout but short. The peristome is brownish, narrowly expanded and a little reflected.

Length 2.3, diam. 1.1 mm.; 5½ whorls.

Length 2, diam. 1 mm.; 5 whorls.

Madeira: in the south, also Deserta Grande and the Southern Deserta (Bugio); Pleistocene of Canical and Pta. S. Lourenzo. Occurs principally under stones and within the hollows of scoriæ of dry and exposed places at a rather low elevation, near the coast (Wollaston).

Pupa millegrana Lowe, Ann. Mag. (2), ix, 1852, p. 277.—Pfr., Monogr. iii, 558; vi, 333.—Kuester, Conchyl. Cab. p. 175, pl. 21, f. 10-12.—Wollaston, Test. Atl. p. 227.

This is the smallest Madeiran species of the genus; more coarsely sculptured than *L. fusca,* with a more massive lower-palatal fold. The whorls are strongly convex.

A young one two-thirds grown has three stout radial folds in the base, at about quarter-whorl intervals. Very young ones of 3-3½ whorls have one or two (pl. 13, fig. 15). Under the microscope the initial 1½ whorls show very delicate light spiral lines in young shells.

39. Lauria abbreviata (Lowe). Pl. 14, figs. 12, 13.

Shell small, rather solid, compact, short, shortly-oblong, the width two-thirds of the length, very obtuse at both ends; closely costellate-striate, somewhat shining. Whorls 6-7, flattened, closely and equally costellate-striate, the last whorl lightly grooved with a subspiral furrow, with rather strong oblique, generally sinuous striae, suture distinct. Aperture semioval subtriangular, 4-plicate: two ventral [parietal lamellæ] parallel, oblique, and one rather large columellar; one obscure, immersed palatal. Lip rather broadly reflected, above with a bend inward at the distinct tooth, which projects inward; respiratory sinus complete. Length 2-2¼, diam. 1¼-1½ mm.; 6-7 whorls (*Lowe*).

Madeira: Pleistocene near Canical, type loc.; extremely rare living.

Pupa abbreviata LOWE, Ann. Mag. N. H. ix, 1852, p. 277; Proc. Zool. Soc. Lond. 1854, p. 213.—WOLLASTON, Test. Atl. p. 235.

This species differs from the ribbed Porto-Santan forms by having the whorls but slightly oblique, the last one quite short, slowly ascending to the aperture, spirally furrowed externally over the lower palatal fold, the base rather pinched. The very high, thin and long angular lamella is united with the lip-insertion by a heavy callus. Parietal lamella rather deep within, long. Columellar lamella horizontal. The lower-palatal fold is very strong, long, deeply immersed. There is a small, quite inconspicuous, less immersed upper-palatal fold, but so far as can be seen in the aperture, no basal fold. The peristome is expanded, and bears a *conspicuous tooth* which nearly touches the angular lamella, almost closing the shortly oval sinulus.

Length 3.6, diam. 1.9 mm.; 7 whorls.

Length 3.25, diam. 1.9 mm.; 7 whorls.

Said to be not uncommon in the calcareous deposits, but almost unique as a recent shell. It is not closely related to any other species, and just where it belongs in the series is uncertain.

40. LAURIA CORNEOCOSTATA (Woll.). Pl. 12, figs. 1 to 5.

Related to *P. relevata*, but a little smaller, less lengthened, and a little more remotely ribbed; umbilicus conspicuously wider; whorls generally a little more plainly banded (rarely quite uniform); last whorl slightly shorter. Peristome having a broad corneous reflection, and less continuous, being somewhat interrupted between the columellar and ventral [parietal] lamellæ, and conspicuously less raised and standing out. The aperture is more sinuate auriform, (less rounded), and 7-plicate instead of 4, the upper columellar, though minute, is hardly completely obsolete, and the 1st and

3d palatals little distinct but immersed. Length 1½ to scarcely 2 lines long (*Wollaston*).

The shell is hazel, or paler above and below a hazel zone, the apex pale. The upper margin of the peristome is irregular, the half between columellar insertion and angular lamella being formed of a heavy adnate callus, reaching as high on the face of the preceding whorl as the upper curve of the outer lip. Only the angular lamella emerges. The supracolumellar is a low, obtuse prominence, deeply placed, in the angle between columella and parietal wall. Lip reflected with thickened face, pale flesh-colored. There are 6 or 7 ribs in 1 mm. on the face of the last whorl.

Length 3.8, diam. 1.4 mm.; 7 whorls.

Length 3.6, diam. 1.35 mm.; 6¾ whorls.

Porto Santo: here and there in fissures of the rocks in the shore zone; especially abundant at Cabeco da Malhada (de Paiva) in the western part of the island, opposite Ilheo de Baixo (Wollaston).

Pupa corneocostata Wollaston, Testacea Atlantica 1878, p. 227, with var. *resticula*, p. 228.

In the still more elongate *L. relevata* the peristome is built out free of the whorl, hence the teeth are more deeply immersed; moreover, its upper margin slopes regularly downward, towards the umbilicus, unlike the irregular but roughly level upper margin of the aperture in *corneocostata*.

Lauria corneocostata resticula (Woll.). Pl. 12, figs. 8, 10.

Peristome more thickened between columellar insertion and angular lamella, continuous, shell plain dark brown or banded.

Length 3.85, diam. 1.4 mm.; 7½ whorls.

Length 3.2, diam. 1.3 mm.; 6¾ whorls.

This form is nearer *L. relevata* in having the peristome continuous, but it differs by the shape of the superior lip-margin. The smaller figure given is from a Wollaston example, the larger from one in the Tomlin collection, also from Wollaston.

41. **Lauria relevata** (Woll.) Pl. 12, figs. 6, 7. 8.

The shell is cylindric, long and narrow, solid, dull brown. Surface sharply and strongly ribbed, the ribs rather oblique, about 8 in 1 mm. on the last whorl. The earlier whorls are quite convex, the later ones somewhat flattened, the suture deeply impressed. Aperture small, ovate-trapezoidal. Parietal lamella emerging, oblique; parietal and columellar lamellæ deeply immersed. Lower-palatal fold long, rather strong, immersed; a very weak, short upper-palatal above it, and below the weak lip-tooth, which is a little within the margin. Basal fold rather feebly developed, immersed. *The peristome is continuous,* reflected, very pale flesh-tinted, the upper margin built out free of the whorl.

Length 4.45, diam. 1.25 mm.; 7¾ whorls.

Length 4.3, diam. 1.3 mm.; 7¾ whorls.

Madeira group: Ilheo de Baixo (near Porto Santo), in crevices of exposed rocks in the shore zone, extreme southern point of the island (Wollaston and Lowe).

Pupa relevata Wollaston, Test. Atlant., 1878, p. 229.

Distinguished characters are the extreme length of this parallel-sided species, together with the shape of the mouth, of which the peristome is built out on a very short neck (fig. 8).

42. **Lauria ferraria** (Lowe). Pl. 12, fig. 12.

The shell is elongate, parallel, cylindric, subopaque, bright rufous or somewhat blackish-brown, closely and sharply costulate, a little less solid (than *corneocostata*). Whorls convex, either uniform or with contrasting bands. Aperture large, rounded ear-shaped, 4-plicate thus: 2 ventral [parietal lamellæ] the outer [angular] thin, lamelliform, oblique, sinuous, the inner [parietal] small, short and deeply immersed. 1 columellar lamella (no supracolumellar). 1 palatal (the first and third wanting). Peristome narrow, thin, somewhat acute, the outer lip rounded (not bent inward), with an obsolete denticle; the indistinct sinulus open. Length about 1⅔ lines (*Wollaston*).

Length 3.8, diam. 1.4 mm. 9-10 riblets in the space of 1 mm. on face of last whorl; closer on preceding whorls.

Madeira group: Porto Santo, in mountains of the western part; Pico d'Anna Ferreira in crevices of the exposed, weather-beaten rocks; also Pico d'Espigao (Wollaston).

Pupa ferraria LOWE, Ann. Mag. N. H. (2) ix, 1852, p. 277; P. Z. S. 1854, p. 211.—WOLLASTON, Test. Atl. p. 230.

Wollaston has discriminated *L. ferraria* and *L. corneocostata* very clearly. The former, somewhat thinner, has more numerous riblets, a narrower, more rounded-out outer lip; the columellar insertion and angular lamella less connected, the callus there being thin and longer in *ferraria;* there is no tubercle in the supracolumellar region and the upper-palatal and basal folds are wanting or reduced to very indistinct vestiges. The parietal lamella is smaller and the angular thinner in *ferraria.*

This species is not so common in collections I have seen as *L. corneocostata.* The latter is often found under the name *ferraria.*

The upper-palatal and basal folds are sometimes present though small.

43. LAURIA DEGENERATA (Woll.).

Shell subconic-cylindric, being slightly tapering towards the apex, opaque, pale brown, remotely but sharply and obliquely ribbed. Whorls convex, strongly swollen, sometimes obsoletely subfasciate. Aperture small, rounded, distinctly 1-plicate, but showing 4 indistinctly, as follows: two on the ventral [parietal] wall, the outer [angular lamella] being small, short, the inner [parietal] minute, deeply immersed and inconspicuous; one small, deeply immersed columellar (no upper columellar); and one immersed, subobsolete palatal fold. Peristome incomplete, being continued only as a thin callus between columellar and angular lamella. Outer lip rounded outwardly, the denticle obsolete; sinulus open, indistinctly defined. Length 1-1½ lines (*Wollaston*).

Madeira group: Porto Santo; four examples found among specimens of *L. monticola pumilio* sent by Baron Castello de Paiva (Wollaston).

Pupa degenerata Wollaston, Testacea Atlantica 1878, p. 231.

An unfigured species which I have not seen.

44. Lauria monticola (Lowe). Pl. 12, fig. 13, 14.

Shell cylindric, chestnut-colored, banded with a pale tint; whorls convex, swollen, sculptured with elevated, equidistant, transverse striae. Suture impressed. Aperture 6-toothed; columella 2-plicate, the posterior fold very obsolete; two contiguous parallel folds in the ventral [parietal] wall, the anterior one smaller, posterior large, continuous with the lip. Lip somewhat reflected, equal, 3-plicate, the intermediate fold larger, anterior and posterior minute. Length 1½, diam. scarcely 1 line; 6 whorls (*Lowe*).

The free edge of the angular lamella curves towards the outer lip. The columellar is well developed, and there may be a small supracolumellar, but more often none. The lower-palatal fold enters deeply, becoming higher within. Upper-palatal is shorter; above it there is a small suprapalatal, also shortly entering. The basal fold is strongly developed, more deeply immersed than the other folds. In all there are 8 teeth, or 7 when the supracolumellar is lacking. The sinuous riblets are about 0.15 mm. apart—7 in 1 mm.—on the face of the last whorl, closer on that above.

Length 2.25, diam. 1.15 mm.; fully 6 whorls.

Length 2.5, diam. 1.2 mm.; 6⅓ whorls.

Madeira group, Porto Santo: Summit of Pico de Facho, among small stones and vegetable detritus; also on that of Pico Branco, often in company with *L. calathiscus* (Lowe and Wollaston).

Helix C. monticola Lowe, Trans. Cambr. Philos. Soc. iv, 1833, p. 63, pl. 6, f. 33.—*Pupa monticola* Lowe, P. Z. S. 1854, p. 212.—Pfr., Monogr. ii, p. 335.—Wollaston Test. Atl. p. 232, with var. *pumilio*, p. 233.

44*a*. *L. monticola pumilio* (Wollaston). Pl. 12, fig. 15.

Rather short, obtusely cylindric, subopaque, reddish-brown, densely costulate. Whorls convex, rather swollen, sometimes banded. Aperture rather small, rounded-auriform, distinctly 6-plicate (indistinctly 7-plicate), thus: two ventrals, the outer oblique, flexuous, the inner a little immersed but not so large; 1 columellar (the upper being subobsolete); and 3 palatals, remote but conspicuously lengthened. Peristome incomplete, being widely interrupted between columella and the outer ventral fold, the outer lip rounded outwardly (scarcely sinuate), with an obsolete denticle, sinulus not very distinct. Length 1 to 1¼ lines. (*Wollaston*).

A trifle smaller, darker and more solid (than typical *monticola*), with its costæ a little less sinuate and more closely set together, and with its ultimate volution and aperture just appreciably less developed; the third palatal plait, on the contrary, being more so, and distinctly larger (*Wollaston*).

Porto Santo, in certain exposed, weather-beaten spots but slightly raised above sea-level.

The distinction between the species and this variety from lower levels seems to me rather slight, being somewhat inconstant in several lots examined from the Lowe-Wollaston collection. A specimen of *pumilio* measures 2.2 x 1.2 mm.; 6 whorls.

45. Lauria calathiscus (Lowe). Pl. 14, figs. 2, 3.

The shell is shortly cylindric, with short conic summit, solid; chocolate or somewhat lighter, with two pale bands, one midway between periphery and suture, the other below the periphery. Surface matt, with sculpture of strong, curved ribs separated by spaces double the width of the ribs. The whorls are very convex. Aperture auriform, with 7 teeth. Angular lamella large, oblique, connected with the lip-insertion, entering nearly to the dorsal side. Parietal lamella very small and short. Columellar lamella strong, not emerging to the peristome. The lower-palatal fold is strong and rather long. Upper-palatal short, united with the lip-tooth, and with the latter defining the sinulus. Basal tooth small, sometimes divided, and like the palatals, arising from a callous ridge. Peristome somewhat expanded; parietal callus thin.

Length 3.6, diam. 2.1 mm.; 6¾ whorls.
Length 3.5, diam. 1.9 mm.; 6½ whorls.
Length 2.7, diam. 1.6 mm.; (Pleistocene).

Madeira group, Porto Santo: summits of Pico de Facho (fig. 2), Pico Branco, etc., in crevices and on ledges of the rocks among vegetable detritus; Pleistocene of Zimbral d'Areia (*Wollaston*).

Helix C. colathiscus LOWE, Cambr. Philos. Soc. iv, 1831, p. 64, pl. 6, f. 34.—*Pupa calathiscus* LOWE, P. Zool. Soc. 1854, p. 212.—PFR., Monogr. ii, 1845, p. 244.—WOLLASTON, Test. Atl. p. 234.

L. calathiscus is larger than any of the related ribbed species, further distinguished by the small parietal lamella, peculiar upper-palatal fold and the strong sculpture. It is type of the section *Eryma* Albers.

This species is found only at high elevations. The fossil form, of which specimens collected by Professor Cockerell are before me, is smaller than recent examples, a peculiarity already noticed by Wollaston.

Section *Wollastonula* Pils.

Wollastonula PILSBRY, this volume pp. 45, 69 (Aug. 29, 1922).

Leiostyliform Lauriæ in which the parietal lamella emerges, and projects into the aperture further than the angular; upper-palatal fold very long, much exceeding the lower, both immersed; sinulus nearly closed. The shell is small and ribbed in the single species known.

L. gibba, the type of this section, is perhaps the most specialized of Madeiran Lauriæ; indeed its evident approach to extinction may be due to over-specialization of the teeth.

46. **Lauria gibba** (Lowe). Pl. 14, figs. 4, 5, 6, 7.

A very small, compact, very shortly cylindric shell, obtusely rounded at both ends, the diam. about ¾ of the length; coarsely ribbed, the ribs curved, rather widely spaced on the last one or two whorls, closer and regular on the preceding whorls, the first 1¾ being smooth. The whorls are only slightly convex, but tend to project a little above the suture; the last one is slightly compressed below the periphery, and slowly ascends to the aperture. The aperture is somewhat trilobed, the lower lobe widely open, upper lobes smaller, contracted. The emerging angular lamella bears a lobe bent towards the sinulus, is not connected with the lip-insertion, and penetrates to the dorsal side. *The parietal lamella is higher than the angular,* and emerges nearly to the edge of parietal callus; it enters straightly, then becomes much lower and turns towards the axis, penetrating to the dorsal side. The columellar lamella is broad, horizontal, and emerges weakly to the peristome; it descends as it enters, and penetrates deeply. Within the outer lip there is a strong marginal tooth defining the sinulus, extending inward in a suprapalatal fold (pl. 14, fig. 7, *sp.*) a long, strongly sinuous, high, deeply immersed upper-palatal fold (fig. 7, *up.*); a lower oblong lower-palatal fold (fig. 7, *lp*), also deeply immersed. Far within the basal margin there is an oblique basal fold (pl. 14, fig. 6 *b.*), not visible in the aperture. The peristome is reflected, somewhat retracted at the sinulus. Parietal callus not very thick.

Length 2, diam. 1.4 mm.; 6⅓ whorls.

Length 2.1, diam. 1.4 mm.; 6½ whorls.

Madeira: at the base of lofty, perpendicular rocks towards the head of the Ribeira de Sta. Luzia, among loose vegetable detritus. Pleistocene in the Canical beds (Wollaston).

Pupa gibba Lowe, Ann. Mag. N. H. (2) ix, 1852, p. 277; Proc. Zool. Soc. Lond. 1854, p. 213.—Wollaston, Test, Atl. p. 235.

Differs from all others by its diminutive size, wide contour, strong ribbing, and especially by the very high parietal lamella, higher than the angular. The parietal lamella is notched where the columellar crosses it, deep in the throat, and the upper-palatal is similarly notched at its upward bend, for the angular lamella.

Only two recent specimens have been found, but it is not very rare in the fossiliferous beds.

Subgenus *Mastula* Lowe.

Mastula Lowe, Ann. Mag. N. H. (2) ix, 1852, p. 278; P. Z. S. 1854, p. 213; monotypic, for *P. lamellosa*.

Short Lauriæ with distinctly spirally striate embryonic whorls, the rest with partially epidermal ribs, the aperture short and wide with nearly simple lip. Angular and columellar lamellæ well developed, but the parietal is small or absent; lower-palatal fold small. Basal teeth of the immature stages are very weak or wanting.

47. Lauria lamellosa (Lowe). Pl. 14, figs. 8, 9, 10, 11.

The shell is small, shortly cylindric or nipple-shaped, shortly subturbinate, very obtuse at both ends, thin, submembranaceous, brown, not banded, lamellate-striate. Whorls 5, convex, swollen, rather remotely, equidistantly, obliquely, transversely ribbed with submembranaceous lamellæ, which spread leaf-like in the middle or are lacerated-aculeate. Suture deeply impressed. Aperture semioval, depressed, wider than long, 3-plicate: one ventral fold [angular lamella] largest; one smaller columellar, situated low; a palatal fold opposite this, immersed, obsolete, indistinctly visible. Lip slightly expanded, very slightly sinuated, with a small, obsolete denticle; the respiratory sinus indistinct, open. Length 2, diam. 1¾ mm.; 5 whorls (*Lowe*).

Madeira: at intermediate elevations in the south; Vasco Gil ravine and Ribeira de Sta. Luzia; fossil at Canical (Wollaston and Lowe).

Pupa lamellosa Lowe, Ann. Mag. N. H. (2) ix, 1852, p. 278; P. Z. S. 1854, p. 214.—Wollaston, Test. Atl. p. 236.

The lamella-like ribs, chiefly epidermal, the scarcely expanded lip, and the absence of any trace of a parietal lamella (while the angular is strongly developed), all distinguish this extremely rare shell from the other Madeiran species.

The largest example seen is a fossil (Pl. 14, fig. 8). It is more cylindric than any recent shell in the series of 15 examined. The whorls above the last are so convex as to appear subangular. There is no parietal lamella, and the lower-palatal fold is very small. Length 2.3, diam. 1.55 mm.; 5½ whorls. If these characters are constant in the fossil form it should be separated subspecifically.

Recent specimens are smaller and taper more. They have a pale band below the periphery. The initial 1½ whorls are finely striate spirally, after which the riblets begin, at first close, then more spaced, and generally high and thin in the middle, especially in immature stages. The lip is scarcely expanded, but is thickened within. The high, thin angular lamella penetrates to the dorsal side. There is a very low and short but quite distinct parietal lamella in one of the specimens. The lower-palatal fold, though small, is more developed than in the fossils. With age it diminishes. The ribs become very weak or obsolete on the base. Length 2, diam. 1.7 mm., 5½ whorls, or slightly larger.

In the immature stages (3 or 4 whorls) the angular and columellar lamellæ are well developed, and there are sometimes weak traces of basal barriers, tubercular or radial. 5 of these appear in the figure; but in some others none are visible (pl. 14, figs. 10, 11).

Species of the Canary Islands.

These forms are related to the Azorean *L. fuscidula* group, the *L. vincta* group of Madeira and to continental species. There is no upper-palatal fold in any specimens I have seen, and the basal fold is often lacking. The three species are closely related, distinguished as follows:

Wider; no callus between the thin angular lamella and the right lip-insertion. Teneriffe. *L. castanea.*

Narrower; generally with a callus between angular lamella and lip-insertion.

Sculpture weak. Teneriffe, Palma, Hierro. *L. pythiella.*

Sculpture stronger and coarser. Teneriffe. *L. tæniata.*

48. Lauria castanea (Shuttl.). Pl. 15, fig. 1.

Shell rimate-perforate, ovate-oblong, striatulate, glossy; chestnut-brown the base paler; spire obtuse. Whorls 6, convex, the last somewhat compressed at the base; suture rather deep. Aperture rounded-ovate, 5-plicate: 1 strong, flexuous angular lamella, remote from the angle; one receding parietal; one strong, inflexed columellar; two palatals, one deeply immersed, the other minute, often obsolete. Peristome fleshy-brown, thickened, expanded, the right margin flexuous above, somewhat tuberculate.

Length 3, diam, nearly 2, aperture 1 mm. (*Shuttl.*).

Length 3, diam. 1.85 mm. (fig.1).

Length 2.9, diam. 1.8 mm.

Canary Islands: Teneriffe and Palma (Blauner). Teneriffe, about wet rocks in the neighborhood of Garachico (Lowe).

Pupa castanea Shuttleworth, Diagn. n. Moll. no. 1 (p. 11 of separates), in Mittheil. Naturforsch. Ges. Bern for 1852, p. 145. — Pfr., Monogr. iii, p. 550. — Mousson, Rev. Faune Malac. Canaries, p. 126, pl. 6.—Wollaston, Test. Atlantica, p. 452.

There is no callus between angular lamella and right lip-insertion. The lower-palatal fold is weaker than in *L. pythiella* or *tæniata*. No basal fold is seen in the specimens examined.

Wollaston considers the locality *Palma* as an error due to confusion with *L. pythiella*. He gives evidence showing that the original specimens of *castanea* were from near *Garachico*. He writes further:

" As compared with the *pythiella*, the *P. castanea* is appreciably larger, broader, and more strictly ovate (or less oval), as well as more coarsely striated; its whorls are more convex (and the suture consequently deeper) and its aperture is more widely developed and more auriform—the margins of its peristome (which is thicker, and of a more livid or carneous tinge, or less white) being much wider apart, and the right hand one more outwardly rounded below the insertion, as well as armed with a more distinct tubercle within. Its upper ventral plait, also, is more lamelliform and less sinuated, and not only a little further removed from the angle of the lip, but usually quite unconnected with the latter by a carneous sphincter.

"Mr. Lowe's examples of this very distinct *Pupa* were taken, during April of 1861, above Garachico, in the north of Teneriffe,—namely adhering to wet rocks and sodden leaves, in the drip of a small waterfall, on the road from that place to Ycod de los Binhos (in company with the Hyalina Clymene, Physa acuta, Ancylus striatus, and Hydrocoena gutta, the moisture loving habits of which it would appear to share". (*Wollaston*).

49. LAURIA PYTHIELLA (Mouss.). Pl. 15, figs. 3. 4.

Shell minute, rimate-perforate, ovate, arcuately striatulate, glossy; chestnut-brown, the base whitish. Spire tapering, ovoid, the summit minute, a little paler; suture linear, not impressed. Whorls 6½, the first somewhat convex, following flat, striatulate at the suture; last whorl not tapering, more convex below the change of color, compressed around the umbilicus. Aperture vertical, one-third the length, compressed semioval, 4-plicate: 2 parietal lamellæ (one long, strong, protracted, often joined to the right lip by a callus, the other thin, deeply placed); one palatal, obsolete, entering; one columellar, strong, inflexed. Peristome thickened, pale, expanded, the right margin flexuous in front, subimpressed laterally, subtuberculate within; columellar margin somewhat sinuous, a little protracted at the insertion. Alt. 3, diam. 1.7 mm. (*Mousson*).

Canary Islands: Teneriffe, in the forest district above Tagenana; Agua Garcia; wood at La Esperanza near Laguna. Palma at El Monte above Barloventa, taken by Lowe; on the ascent of the Cumbre above Buenavista, [type locality]; and on wet rocks in the Pinal, near to the edge of the great Caldeira, at the head of the small stream which supplies the Levada of the Banda. Hierro, in the dense forest region of El Golfo. (Wollaston).

Pupa pythiella Mousson, Rev. Faune Malac. Canaries 1872, p. 127, pl. 6, figs 22, 23.—Pfr., Monogr. viii, p. 389; Novit. Conch. iv, p. 107, pl. 125, f. 22. 23.—Wollaston, Test. Atl. p. 454.

The shell is smaller and narrower than *L. castanea*, with the teeth more fully developed. The angular lamella is usually joined to the lip insertion by a callus. Basal fold is well developed. The base, and usually the summit, are light olivaceous, the remainder brown, varying in shade, but with an olivaceous tinge. Two specimens from the type locality measure—

Length 2.8, diam. 1.6 mm.; barely 6 whorls.

Length 2.6, diam. 1.5 mm.

A young shell (fig. 4) shows three basal laminæ at intervals of about one-eighth of a whorl.

50. Lauria taeniata (Shuttl). Pl. 15, fig. 2.

Shell rimate-umbilicate, globosely ovate, thin, slightly striatulate, pellucid, somewhat glossy, pale corneous zoned with a wide chestnut band visible on all the whorls; spire obtuse, whorls 6, rather flat, the last angularly compressed at base around the umbilicus. Aperture subovate, 5-plicate: 1 strong, bent angular lamella: 1 strong parietal, another very minute, deeply immersed, generally added. 1 strong, inflexed columellar; 2 immersed palatals, one strong, the other minute. Peristome flesh-colored, thickened, a little expanded, the right margin flexuous above. Length about 2⅔, width 1⅔ mm.; aperture 1 mm. long (*Shuttl.*).

Canary Islands: Teneriffe and Palma under dead leaves (Blauner); Teneriffe, in the wood at La Esperanza, near Laguna (Wollaston).

Pupa taeniata Shuttleworth, Diagnosen Neuer Mollusken No. 1 (P. 10 of separate), in Mittheil. naturforsch. Ges. Bern, 1852, p. 144.—Pfr., Monogr. iii, 549.—Mousson, Rev.

Faune Malac. Canaries, 1872, p. 125, pl. 6, f. 18, 19. Reproduced in Novitates Conchologicæ iv, p. 106, pl. 125, f. 18, 19. —WOLLASTON, Testacea Atlantica, p. 455.—*Vertigo taeniata* MABILLE, Nouv. Arch. du Muséum (2) viii, 1885, p. 161.

Wollaston considered *tæniata* and *pythiella* as doubtfully distinct. He writes:—

"Judging from the few examples to which I have access, the *P. tæniata* may be said to have its volutions not quite so flattened and also more strongly striated, being sometimes indeed well-nigh costate, and its surface (instead of being of an almost uniform concolorous brown) is of an olivaceo-corneous hue, but conspicuously banded with a castaneous zone (immediately above its suture) on the hinder portion of each of the whorls".

The figure is from a specimen out of the Wollaston collection. A callus runs from the angular lamella towards the termination of the outer lip. There is a long lower-palatal and a short basal fold. No upper-palatal. Length 3, diam. 1.65 mm., 5⅔ whorls.

Species of the Azores Islands.

A key to these forms was given on p. 73. They are figured on plate 15.

Aside from *L. cylindracea anconostoma* (p. 51), probably an introduced species, the Azorean Lauriæ fall into three groups.

1. Group of *L. tesselata* (Section *Azoripupa*), in which there are many flat whorls, very deeply entering lamellæ, and *two* weak palatals. This is a specially Azorean modification of the Leiostyla stock, unlike anything known elsewhere.

2. Group of *L. fuscidula* (Section *Leiostyla*). These are unspecialized Leiostylæ related to the *taeniata* group of the Canaries and the *vincta* group of Madeira. In the Azores species, as in the Canarian, there is no upper-palatal fold. In the somewhat aberrant *L. vermiculosa* the parietal lamella is disappearing.

3. Group of *L. fasciolata* (Section *Petrarca*). With the color and sculpture of *L. fuscidula*, there has been reduction of teeth—only the angular lamella and a vestigeal columellar remaining.

The Azores Pupillidæ are chiefly known by A. Morelet's account in Notice sur l'Histoire Naturelle des Acores, 1860. Some notes were given by H. Drouet in Eléments de la Faune Acoréenne, 1861. Wollaston has critically reviewed them in Testacea Atlantica, 1878.

One of the species, *L. rugulosa*, described from a single shell, I have not seen.

Section *Petrarca* Pils.

Petrarca Pilsbry, this volume p. 45.

Like Lauria proper; angular and columellar lamellæ are present, but no folds in the outer and basal margins. The surface is finely striate; banded with brown or bicolored. Type *L. fasciolata*.

The sculpture and color of *L. fasciolata* give reason for believing it derived from *Leiostyla*, degenerate in apertural teeth. Otherwise its structure is exactly that of *Lauria* proper, and especially of *L. fanalensis;* a resemblance here interpreted as an instance of convergent evolution.

51. Lauria fasciolata (Morel.) Pl. 7, figs. 16-19.

The shell is deeply rimate, oblong ovate, thin, very minutely striate under a lens; pellucid; corneous, buff or tawny, broadly banded with chestnut. Spire obtuse, the summit slightly tapering; 5 slightly convex whorls. Aperture oval, obtusely angular at the base, biplicate: one entering parietal fold, emerging in an acute triangular lamella, and one slightly emerging columellar fold. Peristome is a little expanded, somewhat lipped, the right margin arcuate, thickened above the middle, the columellar a little dilated and nearly straight. Length scarcely 3, diam. scarcely 2 mm. (*Morel.*).

Azores: "all the islands, under stones" (Morelet and Drouet). Horta, Fayal (Dr. W. H. Rush, 1890); S. Miguel (from O. Boettger coll.).

Pupa fasciolata Morelet, Hist. Nat. des Acores, 1860, p. 198.—Pfeiffer, Monogr. viii, p. 372.—Wollaston, Testac. Atlant. p. 45.

A species resmbling *L. fanalensis* in size and shape, but differing by the much more distinct, fine sharp striation, and by the development of a weak columellar lamella which emerges nearly to the edge of the columellar lip in some examples, in others only so far as to be barely visible. In color, too, it is usually unlike *fanalensis,* yet some specimens are nearly as pale as that species.

The alleged distribution "dans toutes les iles de l'Archipel" given by Morelet has been mentioned by Wollaston in an ironic note. It will probably be found in different racial forms on the several islands inhabited.

The typical form as figured by Morelet, Pl. 7, fig. 16, is transparent grayish ("corneous") with a cinnamon band just above the periphery and a patch at the umbilicus. Columellar lamella distinct.

Length 2.7, diam. 1.5 mm., 5 whorls.

Length 2.5, diam. 1.4 mm.

A single specimen from S. Miguel, pl. 7, fig. 17, is corneous, very faintly brownish above the periphery. One of this color was sent us by Morelet with others of the typical color pattern, the island not specified.

In all adults the angular lamella is a mere thread within, rising triangularly in front, in a short compressed lamella well removed from the termination of the lip.

Immature specimens probably a half whorl short of full size show the usual two lamellæ, rather small, and two extremely weak radial palatal teeth, placed as in *L. cylindracea.* They may perhaps be found stronger in younger shells.

Form *hortana,* n. f., collected at Horta, Fayal, Pl. 7, figs. 18, 19, is chestnut-brown above the periphery, pale olive buff below, sometimes brownish again at the umbilicus. Columellar lamella very weak, less emerging.

Length 2.6, diam. 1.4 mm., 5¼ whorls. Type of *f. hortana.*

Length 2.25, diam. 1.4 mm., 5 whorls.

The color pattern is that of *L. anglica.*

Section *Leiostyla* proper.

52. Lauria fuscidula (Morelet). Pl. 15, figs. 6, 7.

Shell rimate-perforate, cylindric, rounded apically, very minutely striatulate, glossy, corneous, buff, banded with brown, or brown with the base buff. 5 whorls, a little convex, the last compressed basally. Aperture vertical, ovate-sinuate, narrowed by 5 lamellæ: 2 strong, parallel, entering ones on the parietal wall, the right one [angular lamella] emerging, joined to the peristome by an arched callus: left [parietal lamella] further in. One columellar lamella. 2 palatal folds, not reaching the margin, the right one [lower palatal fold] callous, visible outside, subhorizontal, the left one [basal fold] very short, immersed. Peristome a little expanded, calloused, the margins somewhat sinuate, the right margin thickened above the middle. Length scarcely 3, diam. scarcely 2 mm. (*Morelet*).

Azores: "the entire archipelago", under stones and among dead leaves (Morelet). S. Miguel (specimens of form *hexodon*, received from Morelet).

Pupa fuscidula Morelet, Hist. Nat. Açores, 1860, p. 202, pl. 5, f. 5.—Drouet, Faun. Açor. 1861, p. 165.—Pfeiffer, Monogr. viii, p. 377.—Wollaston, Test. Atl. p. 44.

With the color of *L. fasciolata* (with which it is found, according to Morelet), this species differs by its well-developed teeth. The sculpture is far less coarse than in *L. rugulosa* and *L. vermiculosa*.

A barrel-shaped shell, olive-buff with a broad chestnut band in the middle of the last whorl, and occupying the lower half of the preceding whorls, or in other specimens, such as that figured as typical by Morelet, the band spreads over the whole upper surface. In both patterns there is an umbilical spot of brown.

The angular lamella, strongly connected with the outer lip, projects into the mouth but little more than the parietal. Both are rather short, entering only to a dorsal position. The columellar (and when it is present, the supracolumellar lamellæ) enter to about the same point, but the columellar emerges further; the lower palatal fold is well developed but often hard to see on its light background. Basal fold is variable in size. Figures are from specimens received from Morelet.

Morelet has called attention to the radial laminæ within the base of young shells. In one of 3½ whorls there is a lamella on the parietal wall, one on the columella, and two radial laminæ in the base at intervals of ¼ whorl. A nearly adult shell has three such laminæ, and there is one lamina in a specimen with well formed lip and teeth. Morelet states that the young are hardly distinguishable from those of *L. fasciolata.*

L. fuscidula, being reported from "tout l'Archipel" is evidently a wide-spread species which may be expected to show racial differentiation on the several islands. Several forms are present in the series (four lots) examined, but only two lots are definitely localized.

The original account of *L. fuscidula* states that there is one *lamella columellaris.* This is the case in some examples, such as pl. 15, fig. 6, which must therefore be considered the typical form. In some other shells of the same lot, received from Morelet, there is a low and very deeply immersed supracolumellar prominence visible only in an oblique view in the mouth. Whether these forms were associated in life remains uncertain; also, the island is not stated on the label.

Form *hexodon,* n. f. Pl. 15, figs. 9, 10, 11. The supracolumellar lamella is well developed and visible in a direct front view.

Length 2.5, diam. 1.35 mm.; 6 whorls. Fig. 9, type.

Length 2.3, diam. 1.5 mm.; 5½ whorls. Fig. 10.

San Miguel. The type lot, No. 22867, was received from Morelet.

Another form in the collection, represented by a single specimen without record of the island, is very pale, showing scarcely any trace of the brown band. It lacks supracolumellar lamella and basal fold, and the parietal lamella is only about half as high as the angular. Probably this represents another race.

53. LAURIA RUGULOSA (Morel.). Pl. 15, fig. 5.

Shell rimate-perforate, oblong, closely rib-striate, opaque, brown, scarcely shining, at the base buff and obscurely two-banded. Spire cylindric, shortly tapering, obtuse. 5 slightly convex whorls, separated by an impressed suture, the last whorl compressed at base, subangular around the umbilical crevice. Aperture vertical, semi-ovate, 3-folded: 2 lamellæ on the parietal wall, the right one [angular lamella] projecting, joined to the lip by a thin callus, the left one [parietal lamella] further within, smaller: 1 rather strong columellar lamella. Peristome somewhat lipped, narrowly expanded, the right margin somewhat sinuous, lightly calloused above the middle. Length 3⅓, diam. 2 mm. (*Morelet*).

Azores: Pico, in a garden in the western side together with *Helix paupercula* Lowe. (Drouet).

Pupa rugulosa MORELET, Hist. Nat. Acores, 1860, p. 199. pl. 5, f. 3.—PFEIFFER, Monographia viii. p. 372.—WOLLASTON, Test. Atl. p. 46.

Of the single specimen collected Morelet writes:

"A pretty species, distinguished by the close raised and regular striae ornamenting it. This Pupa is neither glossy or transparent. It is of a uniform chestnut-brown color excepting the last whorl, where the base is yellow and shining. This part of the shell contrasts the more conspicuously with the spire because the general tone is strengthened at its border by an indistinct zone of darker color. A second zone marks the dorsal groove produced by the compression of the last whorl of the spire around the umbilicus; both of these bands appear distinctly in the interior."

Morelet does not mention any palatal fold, but his figure (here reproduced) seems to show a lower-palatal.

54. LAURIA VERMICULOSA (Morel.). Pl. 15, fig. 8.

Shell rimate-perforate, ovate, obtuse, vermiculose-ribbed, corneous, opaque, with little gloss, buff-rufescent. Spire obtuse, short. 5 slightly convex whorls separated by a deep suture, the last compressed basally, obscurely banded, slightly ascending in front. Aperture vertical, semioval, 4-plicate: 2 lamellæ in the parietal wall, the right one [angular lamella] strong, prominent, obliquely entering, joined to the peristome by a callus; the left one [parietal lamella] very small, sometimes punctiform. 1 columellar lamella, and 1 rather strong palatal fold. Peristome a little expanding, calloused, the right margin slightly thickened above the middle. Length 2⅓, diam. 1½ mm. (*Morelet*).

Azores: San Miguel, at the foot of the wooded mountains bordering the southern end of the lake in the valley of Las Furnas (Morelet).

Pupa vermiculosa MORELET, Hist. Nat. Acores, 1860, p. 201, pl. 5, f. 4.—PFR., Monogr. viii, p. 390.—WOLLASTON, Test. Atlant. p. 47.

This rare species is figured from a specimen received from Morelet. The sculpture is coarser than in other species of the Azores, the ribs somewhat irregular, entirely wanting on the first 1½ whorls, small on the next whorl, and on the last they do not extend upon the smooth, glossy base. The color is uniform light ochraceous buff in this example, which does not show the "une ou deux fascies peu distinctes à la base" mentioned by Morelet.

The very strongly developed angular lamella is remote from the posterior angle, about in the middle of the parietal margin. It emerges to the edge of the moderate parietal callus. *The parietal lamella is very small and low,* easily overlooked. Columellar lamella strong; above it a low, blunt indication of a supracolumellar. Within the lip there is a strong lower-palatal fold only. Length 2.2, diam. 1.35 mm.; 4¾ whorls.

Section *Azoripupa* n. sect.

Leiostyliform Lauriæ with numerous (8 or 9) flat whorls. The angular and columellar lamellæ penetrate very deeply. Parietal and supracolumellar lamellæ and two palatal folds are present in the type and only species known, *L. tesselata*.

The lamellæ penetrate more deeply than in any other Lauriæ—about two whorls in *L. tesselata.*

55. Lauria tesselata (Morel.). Pl. 15, figs. 12 to 15.

The shell is openly perforate, ovate-cylindric or cylindric-conic, the apex obtuse; irregularly costulate, slightly glossy corneous-buff or tawny, tessellated with squarish chestnut spots. 8 to 9 flat whorls, the last ascending, at the base angularly compressed and pitted. Suture impressed. Aperture trilobed, narrowed by 6 folds: 3 [error for 2] on the parietal wall, the right one [angular lamella] strong, projecting, joined by a callus with the lip; the left one [parietal lamella] further in, smaller; 2 lamellæ on the columella, the upper one larger; 2 thread-like folds trending spirally in the palate. Peristome a little expanded, calloused, the right margin sinuous, columellar margin reflected. Length 4, diam. 2 mm. (*Morel.*)

Azores: Santa Maria, in the mountains of the interior (Morelet), abundant in the laurel and *Myrica* woods.

Pupa tesselata Morelet, Notice sur l'Hist. Nat. des Acores, 1860, p. 204, pl. 5, f. 6.—Pfr., Monogr. viii, 390.—Wollaston, Test. Atlant. p. 46.

This species is strongly characterized by its numerous flat and rather closely coiled whorls and spotted color-pattern.

The angular lamella penetrates 2 whorls inward, and except near the aperture its edge is irregularly serrate (pl. 15, fig. 15). The parietal lamella is less than one whorl long. The columellar lamella also penetrates two whorls, within, and in immature shells it is more prominent than the supracolumellar lamella, though the latter is larger at the aperture. The two palatal folds are thin and rather low, the lower-palatal more immersed than the upper.

Length 4.2, diam. 1.9 mm.; 9½ whorls.

Length 3.5, diam. 1.9 mm.; 8½ whorls.

The neanic stage (pl. 15, fig. 12) shows a prominent angular lamella. There are two on the columella, the lower one, or columellar lamella proper, being more prominent. Within the base there are numerous low, curved radial laminæ, their distal ends trending forward, and thus not parallel to the growth-lines. In the specimen figured, 1.7 mm. diam., there are 6 laminæ at intervals of about one-eighth of a whorl.

The character of the surface varies in different specimens. It was described by Morelet as " irregularly costulate," and this term applies to some specimens; others received from Morelet are nearly smooth, with only a few low riblets, scarcely noticeable. As Morelet noted, the ground color varies. In some shells it is a clear light gray (" corneous ") tint, while others are somewhat brownish. Rarely the brown spots are wanting.

Genus AGARDHIA Gude.

Sphyradium HARTMANN, Erd- und Süsswasser-Gastrop. der Schweiz, 1844, p. 53 (for *S. ferrari* Porro).—REINHARDT, Jahrb. D. M. Ges., 1877, p. 283, type *P. ferrari.* Not *Sphyradium* Charp., 1837, see p. 1.

Coryna WESTERLUND, Fauna der in der Palaearct. Reg. leb. Binnenconch., iii, 1887, pp. 78, 87 (new name for *Sphyradium* Hartmann not Charpentier).—FLACH, Verh. phys.-med. Ges. Würzburg, xxiv, 1890, pp. 2-7. Not *Coryna* Billberg, Monographia Mylabridum, 1833, p. 73.

Agardhia GUDE, Proc. Malac. Soc. London, ix, p. 361, new name for *Coryna* Westerlund, type *P. ferrari* Porro.

Rhytidochasma A. J. WAGNER, Denkschr. math. nat. Klasse k. Akad. Wissenschaften, vol. 91, 1914, p. 48, for the *A. biplicata* group; *A. ferrari* (Porro) here selected as type.

The shell is rimate or narrowly umbilicate, *long and cylindric,* of 6 to 9 whorls, with very obtuse summit and finely rib-striate to nearly smooth surface. Aperture oblong, with 1 to 8 teeth (or sometimes none), margins expanded, subparallel, the outer decidedly longer. In a young stage there is sometimes a low, spiral basal fold (in *A. ferrari*). Tentacles very long, without pigment spots, the animal therefore blind (in *A. lamellata*).

Type *A. ferrari* (Porro). Distribution, southern and eastern Alps and Carpathians, extending south in the Balkan Peninsula as far as Albania and Philippopolis, Rumelia. Living in humid places under bark or wood, deep under stones or in caverns.

The affinities of *Agardhia* are uncertain. The adult shell has some resemblance to *Orcula*. The stages of immaturity have received but little attention. Reinhardt noted that the young *A. ferrari* has a low, spirally entering basal welt but no columellar or parietal lamellæ. Further observation is needed before the position now assigned to *Agardhia* in the subfamily Orculinæ can be considered settled.

Owing to the subterranean habits of part of the species and narrowly restricted range of others, many of the Agardhias are rare shells in collections outside of Italy, Austria and Hungary.

Agardhia probably exists in France as a living snail only in the region of Saint-Martin de Lantosque. Probably all the other records were based upon Pleistocene specimens, either in place or found in river-débris. In the Dép. Alpes-Maritimes this genus appears to have been abundantly represented in the Pleistocene, down to low levels.

Literature.—Our knowledge of these snails is largely due to conchologists of Italy and Austria. Pollonera's paper of 1887 is the most helpful work on Italian forms. His descriptions and figures have been copied by Kobelt in his *Iconographie* der Land- und Süsswasser-Mollusken, n. F., viii, 1889, pp. 98-101, pl. 237, and they are in large part repeated in the following pages.

In 1890 Flach published a review of the recent and fossil species then known (excepting those of Nevill, which he did not mention), with a full and useful key for their determination. Westerlund gave an abridged account of the genus in his Synopsis Molluscorum extramarinorum Regionis Palæarcticæ, 1897, pp. 73-75, recognizing 9 species and 14 varieties and forms. He did not know Flach's work. Finally R. Sturany and A. J. Wagner revised part of the eastern group of species in an important paper published in the Denkschriften der mathematisch-naturwissenschaftlichen Klasse der Kaiserlichen Akademie der Wissenschaften, Bd. 91, Wien, 1914.

At present, 13 recent and Pleistocene species are known, with about an equal number of subspecies, though there are many other named forms. There are 8 Tertiary species. Of the recent species, I have not seen specimens of *A. valsabina, A. stenostoma, A. truncatella formosa,* and *A. t. skipetarica;* also many named forms of other species are known to me only by the descriptions.

NOMENCLATURE. — *Sphyradium* of Charpentier, sometimes used for this group, was a miscellaneous assemblage, given definite meaning when von Martens nominated a species of *Orcula* as its type. The group *Sphyradium* Hartm. contained only *Pupa ferrari* Porro; that species therefore is the type of *Coryna* West. and *Agardhia* Gude, proposed as substitutes. *Coryna* for a beetle was not mentioned by Billberg in the nominative case, as the rules require, but the name came into general use in proper form before the date of Westerlund's work. *Rhytidochasma* Wagner is clearly a synonym of *Agardhia,* as Hesse has already recognized, since it included the type of that group and its immediate allies.

PALAEONTOLOGY.—Agardhia appeared in the upper Miocene of central Europe and continued in the Pliocene of France and northern Italy in forms similar to the living group of *A. biplicata. A. pseudoennea* is somewhat less specialized than the long recent forms by having fewer whorls; but no primitive species of Agardhia have yet been found. The reference of these Tertiary forms to the genus Ennea (as in Conchylien Cabinet, Enneidæ, 1905, p. 348) was doubtless due to insufficient comparisons with the biplicata group of Agardhia.

The Miocene subgenus *Paracoryna* Flach contains small species with fewer, more convex whorls than *Agardhia,* without teeth or having a small, short parietal tooth only. W. Wenz has with good reason expressed doubt whether *P. retusa* and *P. aperta* are related to *Agardhia.* The group may probably belong to *Pupillinæ* or perhaps to the *Vertigininæ.* If related to *Agardhia,* it can only be regarded as the terminus of a lateral phyletic line, far from the main line of descent, since it is likely that the ancestor of *Agardhia* was a 5- or 6-toothed snail. The resemblance to the *A. truncatella* group is one of convergence, since loss of lamellæ in some of the latter group was doubtless a relatively recent event. The *Paracoryna* species has already reached a more mature stage of tooth reduction in the Lower Miocene.

Tertiary species of Agardhia.

(Contributed by Dr. W. Wenz, Frankfurt a. M.)

1. Agardhia bacillus (Paladilhe). *Pupa bacillus* Paladilhe, Rev. Sci. Nat., II, 1873, p. 31, pl. 2, figs. 16-18. Middle Pliocene, Plaisencien: Celleneuve near Montpellier.

2. Agardhia oppoliensis (Andreae). *Coryna oppoliensis* Andreae, Mitt. a. d. Roemer-Museum, Hildesheim, no. 18, 1902, pp. 16, 27, fig. 8*a*; with var. *turrita*, fig. 8*b*. Upper Miocene, Tortonien: Landschneckenmergel, Oppeln.

3. Agardhia praeambula (Flach). *Pupa* (*Coryna*) *praeambula* Flach, Verhandl. d. phys.-med. Ges. Würzburg, n. F., XXIV, 1890, p. 50, pl. 3, fig. 2. Upper Miocene, Tortonien: Braunkohlenton, Undorf bei Regensburg.

4. Agardhia proexcessiva (Sacco). *Pupa* (*Coryna*) *proexcessiva* Sacco, Mem. R. Accad. Sci. Torino, Cl. Fis., Mat. e Nat. (2), XXXIX, 1888, p. 76, pl. 1, fig. 2; I Moll. terr. Terz. Piemonte, pt. 22, 1897, p. 70, pl. 6, f. 4.—*Coryna praeexcessiva* (Sacco), Flach, Verhandl. Würzburg, XXIV, 1890, p. 7. Upper Pliocene, Astien: Tassarolo, Prov. Alessandria, Piedmont.

5. Agardhia pseudoennea (Flach). *Pupa* (*Coryna*) *pseudoennea* Flach, Verhandl. d. phys.-med. Ges. Würzburg, n. F., XXIV, 1890, p. 51, pl. 1, fig. 5. Upper Miocene: Tortonien: Braunkohlenton, Undorf bei Regensburg.

Subgenus Paracoryna Flach.

Paracoryna Flach, Palaeontologische Beiträge, in Verhandl. d. phys.-med. Ges. Würzburg, n. F., XXIV, 1890, p. 4 (for *diezi* and *retusa*).

Aperture wholly toothless. Surface finely, irregularly striate with occasional more strongly raised striæ. Very similar in habit to the Pupillæ (Flach). Type: *P. diezi* Flach.

Flach's figures of *P. diezi* are reproduced in pl. 19, figs. 17, 18. A specimen of *A. retusa* from the Hydrobienschichten, Wiesbaden, is drawn in pl. 19, fig. 16.

Flach's definition requires modification to provide for *A. retusa,* in which a parietal lamella is sometimes represented by a low, oblong tubercle.

6. Agardhia diezi (Flach). *Coryna diezi* Flach, Verhandl. d. phys.-med. Ges. Würzburg, n. F., XXIV, 1890, p. 49, pl. 3, fig. 1. Lower Miocene, Burdigalien: Landschneckenkalk, Tuchorschitz.

7. Agardhia retusa (Sandb.). *Pupa retusa* (Al. Braun in Walchner, Handbuch d. Geognosie, 2d. edit., p. 1136, *nom. nud.*!) Sandberger, Die Conchylien d. Mainzer Tertiärbeckens 1859, p. 53, pl. 5, figs. 12-12c.—*Coryna retusa* Boettger, Jahrb. Nassau. Ver. f. Naturkunde, Wiesbaden, XLII, 1889, pp. 242, 320.—*Pupa anodonta* Braun, Sandberger, Vorwelt, 1875, pl. 25. Lower Miocene, Aquitanien: Hydrobienschichten, Mainz, Budenheim bei Mainz.

8. Agardhia reperta Wenz, Fossilium Catalogus Pt. 20, III, 1923, p. 1039, n. n. for *Pupa aperta* Sandberger, Neues Jahrb. f. Min., Geol. u. Pal., 1895, I, p. 216 (not *Pupa aperta* v. Martens, 1863; not *Pupa aperta* Sandb. ms., Miller, see Vol. XXV, p. 219.—*Agardhia aperta* (Sandberger), Gottschick u. Wenz, Archiv f. Molluskenkunde, 1921, p. 212, fig. 1. Upper Miocene, Sarmatien: Steinheim am Albuch, Württemberg.

Key to Recent Species of Agardhia.

1 { Aperture without palatal folds but sometimes a lip-tooth present. (Section *Agardiella*) (8).
2 to 4 more or less immersed palatal folds present. (Section *Agardhia* proper) (2).

2 { Outer lip distinctly toothed within (3).
Outer lip not toothed, though more or less thickened within (7).

3 { Peristome free, the parietal callus being built forward (4).
Parietal wall of the peristome adnate, thin or thickened; surface smoothish or very lightly striate (6).

4 Surface finely, closely rib-striate; base umbilicate (5).
Surface smoothish or very slightly striate; nearly imperforate. *A. valsabina*, no. 3.

5 Aperture much contracted, the lip-tooth large. *A. blanci*, no. 2.
Aperture less contracted, lip-tooth smaller. *A. ferrari*, no. 1.

6 Teeth rather small; parietal callus thin. *A. biplicata*, no. 5.
Teeth somewhat larger; parietal callus thick. *A. bourguignatiana*, no. 4.

7 Surface distinctly but finely rib-striate. *A. bielzi*, no. 7.
Striation weak, subobsolete. *A. excessiva*, no. 6.

8 Deeply constricted behind the peristome, the constriction terminating and strongly deepened below the sinulus. Three strong lamellæ on the parietal wall. Aperture much narrowed, outwardly notched, very oblique, nearly slit-shaped. Rib-striation as in *parreyssii*. *A. stenostoma*, no. 12.
Not constricted behind the peristome, though often pitted externally at middle of outer lip (9).

9 A distinct tooth within middle of outer lip (10).
A callus in middle of outer lip and extending downwards, not distinctly tooth-like and often very weak (14).

10 Parietal lamella appearing weakly S-shaped in a basal view; a basal fold present; columellar lamella strong; aperture narrow. *A. lamellata*, no. 10.
Parietal lamella straight or only slightly arcuate in a basal view; no basal fold (11).

11 Columellar lamella strongly developed; lip-tooth massive; length about 4 mm. (12).
Columellar lamella small or wanting; lip-tooth rather small (13).

12 Columellar lamella bilobed; about 15 riblets in 1 mm. on face of last whorl; diam. ⅓ the length. *A. macrodonta,* no. 8.
Columellar lamella simple; about 22 striæ in 1 mm.; diam. less than ⅓ the length. *A. m. gracillima,* no. 8*a*.

13 14-16 fine rib-striæ in 1 mm. on face of the last whorl; peristome rather broadly expanded below. *A. rumelica,* no. 9.
11-12 more spaced riblets in 1 mm.; peristome narrow. *A. t. biarmata,* no. 13*b*.

14 Whorls distinctly flattened, the last one or two relatively long; outer lip receding strongly to the suture. *A. parreyssii,* no. 11.
Whorls somewhat convex, slowly and regularly increasing (15).

15 Shell 3.6 to 4 mm. long, 6½ whorls; rib-striæ spaced, 10-12 in 1 mm. on face of last whorl; aperture toothless or with small lamellæ. *A. truncatella,* no. 13.
Shell 5 to 5.5 mm. long, 8 whorls; striation finer. *A. t. formosa,* no. 13*a*.
Shell 4 mm. long, very finely striate; aperture toothless. *A. t. skipetarica,* no. 13*c*.

Subgenus AGARDHIA proper.

The species are closely related, separated by various combinations of these characters: striation; degree of development or absence of a lip-tooth; form of peristome; size of the palatal folds; form of base and umbilicus. Part of their characters may be tabulated thus:

(Names in *italics* are rib-striate species, the others smoothish.)

Lip-tooth present	*ferrari* *blanci*	Parietal margin of peristome free.
	valsabina	
	bourguignatiana biplicata	Parietal margin of peristome adnate.
No lip-tooth	excessiva *bielzi*	

Of these forms, *A. blanci* is probably a mere local race of *ferrari*. The others seem to be valid species. Perhaps most of the named varieties of *blanci* and *bourguignatiana* are superfluous.

1. Agardhia ferrari (Porro). Pl. 17, figs. 18 to 22.

The shell is narrowly umbilicate, cylindric, blunt at the ends, cinnamon-buff, paler at the rounded summit. First 2 whorls are smooth, riblets then beginning weakly. The cylindric part is closely and evenly costulate, the riblets oblique, retractive, becoming less oblique on the last whorl, where there are about 13 in a millimeter. They become finer behind the peristome. The whorls are slightly convex, the last one contracted and turning forward as it approaches the aperture, pinched into a prominent keel at the base; there is an impression behind the outer lip above the middle, and a shallow furrow near and parallel to the base. The aperture is trapezoidal, rounded below, angular above, the sides subparallel. There is a strong, oblique parietal lamella and a transverse, median columellar lamella, neither of them reaching the peristome. Three deeply-placed palatal folds, the lower-palatal moderately long, the wholly immersed basal very short; often another minute fold, the sutural, is present, making 4 in all. The peristome is well reflected, thickened, continuous and free, being built forward a little.

Length 4.9, diam. 1.8 mm.; 9⅔ whorls. Lugano.

Length 4.1, diam. 1.7 mm.; 8⅔ whorls. Lugano.

Italian Alps of Lombardy and Piedmont and the immediately adjacent parts of the Tyrol and Switzerland (southern part of Prov. Ticino); also Quaternary of Dép. Alpes-Maritimes. Special localities reported are: Valgana in Prov. Como (Porro, type loc.); around Lugano, Pazzalino, Castagnola, Cadro, Monte Bré in the Lake Lugano region (Stabile); Varenna, Edolo, Esino, also Nice and San Remo (Flach); near Anfo on Lago D'Idro (Spinelli). In France, Pleistocene of the Tumulus de Nove near Vence, Dép. Alpes-Maritimes (Bourguignat).

Pupa ferrari Porro, Malacologia terrestre e fluviale della

Provincia Comasca, 1838, p. 57, pl. 1, f. 4*a-e*; with var. *elongata, intermedia, guttula.*—KUESTER, Conchyl. Cab., *Pupa*, p. 59, pl. 7, f. 22-25.—PFR., Monogr., ii, 333.—GREDLER, Nachrbl. D. M. Ges., xi, 1879, p. 112 (Val Lorrina, Tyrol).—STABILE, Delle conchiglie terr. e fluv. del Luganese, 1845, p. 35, with var. *parva;* Prospetto sist.-statist. dei Molluschi terr. e fluv. viv. nel territorio di Lugano, 1859 (in Atti Soc. Geol. Milano, i, fasc. 3, pp. 33, 58, with mut. *normalis* based on Porro's var. *elongata*, fig. 4 *a, b, c.* — POLLONERA, Bull. Soc. Malac. Ital., xii, 1887, p. 219.—PINI, Bull. Soc. Malac. Ital., ii, 1876, p. 165 (Esino territory). — O. REINHARDT, Nachrbl., vol. 46, 1914, p. 75 (immature shell). — *Sphyradium ferrari* HARTMANN, Erd- und Süsswasser-Gastropoden der Schweiz, 1844, p. 53, pl. 14, f. 1, 2, and as *S. guttula,* f. 3, 4.—CLESSIN, Molluskenfauna Oesterreich-Ungarns, 1887, p. 248, f. 149.—*Coryna ferrari* Porro, WESTERLUND, Synops. Moll. extramar. Reg. Palæarct., 1897, p. 74. — CAZIOT, Etude Moll. terr. et fluv. Monaco et Dép. Alpes-Maritimes, 1910, p. 334, pl. 8, f. 10, 11. —LOCARD, Ann. Soc. d'Agric. Sci. Ind. Lyon (7), iii, 1896, p. 213.—FLACH, Verh. phys.-med. Ges. Würzburg, xxiv, 1890, p. 7.

Pupa biplicata ROSSMAESSLER, Iconogr., 1839, ii, p. 26, pl. 49, f. 641; not of Michaud.

The combination of a continuous, free peristome, a strongly pinched base and a finely ribbed surface distinguishes *A. ferrari* from all species except *A. blanci,* which differs chiefly by its larger teeth.

Porro noticed three sizes, thus:

VAR.: (a) *elongata,* alt. mill. 5, width mill. 1½, whorls 8.
(b) *intermedia* [no definition].
(c) *guttula,* alt. mill. 4, width mill. 1½, whorls 7.

Stabile proposed the term "mut. *normalis*" for Porro's *elongata* without other definition. He added a var. *parva,* alt. 3½, width 1½ mm., Prov. Ticino, Switzerland. So far as I know, these mutations in length have no racial status, being fully connected by intermediate sizes in the same lot, as Hartmann stated over 80 years ago in his good account of this snail. All of the shells before me fall between 4 and 5 mm. in length.

The records of this species as a living snail in the Dép. Alpes-Maritimes are vague and unsatisfactory. Caziot had not found it up to 1910; but Bourguignat's record from a Pleistocene or Holocene deposit near Vence is authentic so far as I know, but seems suspicious in view of the fact that *A. blanci* is also reported from that place. This is the only definite locality for *A. ferrari* in France, and is a long distance from any known Italian or Swiss locality.

Flach, who collected many *A. ferrari* on the Comersee noted a wide range of variation in shape of the shell, of the aperture, and in the teeth, the sculpture and number of whorls being more constant. He considered *A. blanci* a form of *ferrari*.

Reinhardt thus described the young shell:

> Young specimens of *Pupa ferrari* Porro are very similar to those of *P. pagodula* with which they occur; having the characteristic Solarium shape with widely open umbilicus. The striation, sharper than in *P. pagodula*, begins on the first whorl immediately after the smooth nucleus. The shell is at first quite colorless, glassy-clear, and only gradually takes on a light yellowish brown tint. Of the columellar fold nothing is seen; but on the base of the temporarily last whorl there is a relatively wide, white spiral band, a little raised, and without thickenings or projections, traceable about a whorl inward and with a double-edged appearance. In preceding whorls it is absorbed.

2. Agardhia blanci (Bgt.). Pl. 17, figs. 3, 4, 5.

Shell deeply pervious-umbilicate, cylindric, obliquely hair-costulate, especially on the last whorl, the apex smooth, very obtuse. Nine slightly convex whorls, regularly and slowly increasing, separated by an impressed suture, the last whorl not descending but rather slightly ascending, compressed-contracted, grooved near the lip and at base, and acutely carinate below around the umbilicus. Aperture nearly vertical, contracted, sinuous, angular above, somewhat channelled below; 5-toothed, as follows: one strong, straight, deeply placed parietal lamella; one stronger immersed lamella on the upper part of the columella; two deeply immersed palatal folds, of which one above is punctiform, scarcely visible, the other below is lamelliform; on the outer lip a thick triangular tooth. Outer lip sinuous, arching forward; columellar margin straightened; peristome continuous, free, lipped within, expanded and reflected throughout, especially on the lower margin. Length 5, diam. 2 mm. (*Bourguignat*).

Length 4.3, diam. 1.65 mm.; 9 whorls. St.-Martin.

Length 4.2, diam. 1.7 mm.; 8½ whorls. St.-Martin.

Alpes-Maritimes: lower layer of the Tumulus de Nove, near Vence, abundant (Bgt.); near Saint-Martin de Lantosque, about 50 living specimens under an old stump (Charles Hedley).

Pupa blanci BOURGUIGNAT, Cat. Moll. plan. de Nove, in Soc. Sci. Lettr. et Arts de Cannes, iii, 1873, p. 282.—POLLONERA, Bull. Soc. Malac. Ital., xii, 1886, p. 218, with var. *niciensis*, p. 219, pl. 6, f. 3, 4.—*Coryna blanci* Bgt., CAZIOT, Etude Moll. terr. et fluv. Monaco et Dép. des Alpes-Maritimes, 1910, p. 335, with var. *niciensis* Poll., p. 336.—? *Coryna curta* LOCARD, see below.

"It differs from *P. ferrari*, the only comparable species, by the more strongly and vigorously striate shell, the more sinuous outer lip, thicker, more developed and provided with a stouter triangular peristomial tooth; by its narrower aperture, relatively higher, by the umbilical perforation far more open, funnel-shaped, so that the whorls can be seen within" (*Bgt.*).

The chief difference from *ferrari* is in the teeth, especially the lip-tooth, which is certainly much larger in *blanci* so far as the specimens at hand are concerned. Generally the aperture of *blanci* is narrower than in the Italian species, and the umbilicus is somewhat larger. The striation can be exactly matched in some examples of *ferrari*. The striæ are strong but rounded, and about equal to their intervals. They are rather oblique (retractive) on the spire, more nearly vertical on the last whorl, where I count about 13 in a millimeter.

Flach, who collected long series of *A. ferrari*, found the proportions of shell, aperture and teeth quite variable, and it appears likely that *blanci* is merely a western subspecies of that common north Italian species, as he claimed.

This is a quite local form, its known localities falling within an area of about 25 miles along the coast, and in one place an equal distance inland. On low levels it is known only as a Pleistocene (or possibly Holocene) fossil, or in river drift; but Charles Hedley found it living in the Alpes-Maritimes over 35 years ago. As a living mollusk it is probably restricted to the cooler, more humid zone of this range.

Bourguignat had only fossil examples, and probably he overlooked the sutural and basal folds, which could be seen only by breaking the shell if they are present in the type. In fresh shells they can be seen from the outside, shining faintly through the shell, as in fig. 4 on pl. 17. All of the lamellæ and folds are immersed and hard to observe. The color of living shells is cinnamon-buff.

Coryna curta Locard came from a locality where *A. blanci* is known to exist, and it will probably prove to be a short form of that species. The size of the teeth and of the umbilicus, which distinguish *blanci* from *ferrari*, were not brought out by Locard, whose description follows:

Coryna curta Locard. Subcylindric, very short and squat, tapering a little at the base; 7 to 8 quite convex whorls, the suture marked. Aperture trapezoidal, a little receding towards the base, somewhat channelled above; with 1 robust, superior, median and emerging fold, 1 equally stout, immersed columellar situated somewhat high, 3 palatals, of which a tubercular one is on the peristome, and the others rudimentary and very indistinctly visible. Peristome continuous, thick, a little spreading. Shell corneous-red, ornamented with fine, close rib striæ. Height 3¼ to 4, diam. 1¾ mm. Menton et Saint-Martin-de-Lantosque, Alpes-Maritimes (*Locard*, Les Coquilles terrestres de France, 1894, p. 326; Ann. Soc. d'Agric. etc. (7), iii, p. 214).

2*a*. *A. blanci niciensis* (Poll). Pl. 17, figs. 1, 2.

Differs from the typical form by having the columellar lip calloused, subdentate; 4 palatal folds. Il Nizzardo; 2 specimens in debris of the Varo (*Pollonera*).

Pollonera further says that the end teeth of the palatal series are extremely small. The columellar callus is swollen, almost forming a tooth opposite that of the outer lip.

The specimens known may have floated down from a higher elevation in the Alpes-Maritimes.

2*b*. *A. blanci jolyana* (Nevill). Pl. 17, figs. 6, 7, 8.

Shell deeply and broadly umbilicate, regularly cylindric-ovate, obtuse, silky, corneous; closely, more or less obliquely, costulate, the riblets a little flattened, scarcely acute. Whorls 8, regular, slightly convex, the last larger, compressed at base and acutely carinate around the umbilicus. Aperture vertical, extremely narrow, 4-plicate; parietal lamella strong, conspicuous, twisted, slightly oblique; columellar lamella deep within, strong, transverse; palatal folds remote, hardly visible. Peristome white, continuous, free, very wide and thickly reflected, the upper margin strongly bent in, forming an acute angle with the outer margin; outer margin nearly straight, bearing a very strong tooth above the middle; columellar margin straight. Length 4, diam. 1½ mm. (*Nevill*).

Menton: 4 specimens in deposit *B*. Type in Indian Museum; also in coll. Bourguignat.

Pupa (*Sphyradium*) *jolyana* G. Nevill, Proc. Zool. Soc. Lond., 1880, p. 129, pl. 13, f. 8.—*P. iolyana* Nevill, POLLONERA, Bull. Soc. Malac. Ital., xii, p. 221.

3. AGARDHIA VALSABINA (Spin.). Pl. 18, figs. 1, 2, 3.

Shell subperforate; cylindric, the apex obtuse; smooth, glossy, corneous-buff; suture impressed; whorls 7-8, nearly flat, the last compressed-carinate at base. Aperture narrow, oblong, contracted, with one very long parietal fold, one transverse columellar, two palatals [error for 4, the sutural and basal ones minute, not seen by Spinelli]. Peristome continuous, white-lipped, expanded, free and shortly built forward; right margin having a callus, columellar margin straight. Length 4½ to 5, diam. 1⅔ mm. (*Spinelli*).

Italy: Pieve and Anfo in Valsabbia, shore of Lago d'Idro, at the foot of Mt. Sassello (Spinelli).

Pupa valsabina SPINELLI, Cat. Moll. Bresciani, 1851 (not seen by H. P.); Seconda Edizione, Catalogo dei Molluschi terrestri e fluviatili della Provincia Bresciana, 1856, p. 25, fig. *A*, 1, 2 of plate.—POLLONERA, Bull. Soc. Malac. Ital., xii, 1886, p. 215, pl. 6, f. 11, 12.

Pollonera, whose figures are reproduced, pl. 18, figs. 1, 2, states that *P. valsabina* differs from *ligustica* by its more strictly cylindric shape, the whorls flatter, the suture less impressed, the surface smoother, the umbilicus practically closed; and above all by the characters of the aperture, which is *very narrow* with the *peristome continuous and free,* and oblique in a direction opposite to that of the other species. The deeply placed palatal folds are *short,* thick, and not parallel to one another as in other species. The upper and lower ones are punctiform. Length 4, diam. 1¼ mm.

Spinelli's poor figures are reproduced photographically in my pl. 18, fig. 3. I have not seen the species, and have accepted Pollonera's identification, considering Gredler's *Pupa spinellii* as probably synonymous. Gredler identified two specimens taken by Baron A. von Tiesenhausen in Val Lorina, an alpine transverse valley of the Val Ampolo, as the true *P. valsabina,* which he considers a variety of *biplicata.*

P. spinellii. — Gredler (1885) raised the question whether Spinelli's specimens were found in drift débris of the lake shore; if so, they were possibly derived from the adjacent Tyrol, Judicarien, Val Ampola, etc. In a later communication (1889) he stated that Spinelli, in his old age, sent him two specimens as his *P. valsabina;* but that he (Gredler) believes that they are really a distinct species, which he proposes to name *P. spinellii;* his notes of 1885 pertaining to this, and not to the true *valsabina.* The substance of these notes, by which *spinellii* is solely known to me, here follows.

The contraction of the aperture [which is so extraordinary that it could almost be called a (diagonal-) vertically placed slit] is due not only to the callus of the outer lip, but this itself apparently depends on the reflected, backwardly rolled peristome, which is pinched in behind; to which may be added that the contraction is due also to the lightly bent inward columellar margin, which in *biplicata* and *ferrari* is bowed outward. In fact, the aperture, which is a long quadrangle in the two species compared, is here so narrow that it can hardly be called fusiform or elliptical (rather bilocular); and above, as below, it almost runs out and recurves in a spout, and is placed more oblique to the axis. The second half of the last whorl is flattened on both sides, and set off from the rest of the height by a deep notch on the umbilical side, as though strangled, so that this part is hardly continuous with the rest of the shell, and appears like a carved pouch. The peristome is straight throughout and without thickening, only in the middle of the outer margin laid out or finished with a callus, the margins not as in *biplicata* remote with a mere connecting callus, but directly connected and produced far forward, the columellar margin vertical fold-striate outwardly; the keel of the neck becomes gradually less acute backward from the peristome, and not circularly surrounding the umbilical slit, but angularly broken in the middle. Finally, valsabina [*spinellii*] does not reach the size of the compared allies.

Gredler states that it has 8-9 whorls and four palatal folds.

The following references pertain to this form:

Pupa valsabina Gredler, Nachrbl. D. Malak. Ges,, 1885, pp. 33-36. — *Pupa* (*Sphyradium*) *spinellii* Gredler, Nachrbl., 1889, pp. 198-200.

4. Agardhia bourguignatiana (Nevill). Pl. 17, figs. 9, 10, 11.

Shell openly perforate, cylindric, regularly tower-shaped, the apex obtuse, smooth, glossy. Ten slightly convex whorls, nearly equal, separated by an impressed suture, the last whorl short, a little compressed below; under a lens obsoletely striatulate, the striæ a little oblique, regular. Aperture narrow, triangular, dilated above, tapering and compressed below, provided with 4 minute folds; parietal lamella very strong, a little oblique; columellar lamella prominent, nearly straightly transverse; 2 scarcely visible palatals. Peristome expanded, thickened, the margins joined by a thick callus, the right margin having a strong tooth above the middle, the columellar margin abruptly bent down above the middle. Length 5⅙, diam. scarcely 1½ mm. (*Nevill*).

Alpes-Maritimes near the Italian boundary and over it, in Pleistocene deposits *A, B* and *C*.

Pupa (*Sphyradium*) *bourguignatiana* G. Nevill, Proc. Zool. Soc. Lond., 1880, p. 127, pl. 13, f. 5, with subvar. *obesa,* p. 127; var. *tumida,* p. 128; var. *plagiostoma,* p. 128, pl. 13, f. 6; subvar. *angusta,* p. 128; var. *præclara,* p. 129, pl. 13, f. 7; var. *grimaldiensis,* p. 129.

This was exceedingly abundant in deposits *A, B, C*; I found a single specimen in deposit *F*, of a short, thick-set variety (var. *tumida*), probably enough a distinct species. Typical *Pupa biplicata* Mich. and *P. ressmani* Villa are the nearest forms I know to *P. bourguignatiana;* from both the present species can be told at once by the above-described characters of the aperture. A specimen from Tuscany which I obtained from Madame Viment at Paris, labelled *P. biplicata*, is a totally distinct species from the Menton one; it is the *P. toscaniæ* of Bourg. (*Nevill*).

A. ligustica (Poll.) appears to be a living representative of this Pleistocene form, probably not specifically distinct.

The deposits in which the Menton shells are found have been described by Nevill as follows:

A. Alpes-Maritimes, a few yards only from the Italian frontier, a stone's throw from the "Pont St. Louis," estimated about 50 yards above the sea, in a deep cutting of the high road under the larger boulders about the level of the road, buried beneath approximately 20 ft. of conglomerate.

B. Underneath the railway viaduct, almost exactly in front of the first cavern, something like 100 metres west of the tunnel, and about the same distance east of the Gorge St. Louis (frontier), about 20 meters above the sea. After passing through the arches one finds before one a small amphitheatre, in which these shells can be found here and there in astonishing profusion.

C. Deposit, with a southern aspect, a little more to the east than the preceding and somewhat lower down, a few feet only above the sea, in a cutting of the new road which is being made along the seashore for working a stone-quarry, on the sea front of the tunnel. The conglomerate, above the shells, was here about 20 to 30 feet in thickness. I am not sure that the mollusks lived on this spot.

D. Deposit, with a northern aspect in a cutting of the railroad about a quarter of an hour's walk to the east from the preceding, about a hundred yards east of the tunnel.

In these deposits the shells are mainly found under large rocks.

Nevill defined five varietal and subvarietal forms of *A. bourguignatiana*, three of which he thought might be species. That so many closely related *races* existed in this very limited area seems unlikely; a wide swing of individual variation appears more probable. The group of forms is known to me only by Nevill's lengthy work, here reproduced. He wasted much ink and good white paper over a small matter.

Subvar. *obesa* Nevill. "Whorls 8½, a little more convex and more rapidly increasing, the last longer, scarcely compressed at base; aperture more ample, less contracted below, the columellar margin straighter. Length 5, diam. 1⅝ mm." (*Nevill*).

Evidently this is what Nevill referred to as "var. *tumida*" in his remarks on *bourguignatiana*, since that name does not occur elsewhere in his paper.

Var. *plagiostoma* Nevill. Plate 17, figs. 12, 13, 14.

"(An potiùs *Pupa plagiostoma* n. sp.?)

"This is a well-marked and very distinct form, distinguishable at a glance by the characters of the aperture which appear to be constant. It was by no means rare in deposits *B* and *C*.

"Spire slightly convex, less gradually tapering (or turreted); whorls 8½, the first 3½, increasing rapidly, the others of almost equal breadth, the last one longer in proportion, more compressed at its base, so much so that it has a subcarinate appearance round the umbilicus. Striation a little more distinct and more oblique. Aperture quite differently shaped, not triangular, but more compressed, narrowly oblong, as broad at its base as above, both columellar and parietal folds more twisted, the former less straightly transverse; the two palatal ones, seen through from the back, appear more callous and to run into one another; in the type form they appear to run more or less parallel. The peristome even more callously thickened, with its margins joined by a more developed callosity; the columellar margin has a very slight bend at its commencement, otherwise it is quite straightly oblique, without the characteristic deflection of *P. bourguignatiana;* the callous tubercular tooth on the outer margin equally prominently and robustly developed; this tooth appears to be peculiar in the group to the Menton species, in which it exists in every specimen and in all the varieties, the other species merely possessing a slight thickening in its place, as far as I know. Long. 4½, diam. 1¼ mm," (*Nevill*).

Subvar. *angusta* Nevill. "This is a by no means rare form, which has decided me on not specifically separating the preceding. It has a similar aperture, as also a coarser striation, but possesses 10 whorls, the first eight of which are even more cylindrical than in the type form, and more compressed, the last two being in proportion stouter and more convex, imparting to the spire a remarkably emaciated appearance.

"Types of the variety and subvariety are in the Indian Museum, Calcutta, also in collections of M. M. Bourguignat and Coombe Williams" (*Nevill*).

Var. *præclara* Nevill. Plate 17, figs. 15, 16, 17.

"(An potiùs *P. præclara*, n. sp.?).

"This I for some time considered a distinct species; at any rate it is a well-marked, constant variety. It was not rare, in deposit *B* only, and often in such perfect preservation that it looked as if the animal had only just been extracted. Spire slightly convex, much like that of var. *plagiostoma*, but more pupiform, that is more tumidly swollen, not so attenuately contracted. Whorls 8 to 9, the last two proportionally more swollen and convex, the last not compressed at its base (in this unlike all the preceding), very translucid, so much that the columella can be traced sometimes nearly to the apex; smooth, shining, no trace of the oblique sculpture characteristic of the preceding; the aperture is not unlike that of var. *plagiostoma*, though less contracted, equally oblong, as broad below as above—that is with the margins parallel; the parietal fold considerably less vertical than in the type form; the columellar one similarly straightly transverse, the palatal ones, as seen through the back of the last whorl, seem to me much the same; the outer margin is less straight than in any of the preceding forms—that is to say, is more pinched in at the callous tooth and is consequently more arcuate above and below; the columellar one considerably less oblique, above scarcely twisted, at base more gradually rounded. Long. 4½, diam. (*vix*), 1½ mm.

"Type var., Indian Museum, Calcutta; also in coll. Bourguignat and Coombe Williams" (*Nevill*).

Var. *grimaldiensis* Nevill.

"(An potiùs *P. grimaldiensis*, sp. nov.?)

"This form, I believe, will eventually prove to be distinct from its allies found on the other side of the headland, as is the case with species of *Clausilia* and *Pomatias;* as, however, I only found, in deposit *D*, a single specimen (the preceding forms not being found there at all), I do not feel justified at present in describing it as a distinct species.

A short, tumid, pupiform variety, with only 7 whorls, more convex and increasing more rapidly than in any of the preceding, the last one perfectly rounded at base; the aperture much shorter and less contracted, with much less conspicuous folds, which are further within; the columellar margin more broadly reflected but less callous, without any twist or deflection whatever, scarcely oblique, almost rounded at base; outer margin with its well-developed tooth as in the type form. Long. 4, diam. 1⅝ mm.

"Unique type var., Indian Museum, Calcutta" (*Nevill*).

4*a*. *A. bourguignatiana ligustica* (Poll.). Pl. 16, figs. 6, 7.

Shell cylindric, narrowly umbilicate, pellucid, glabrous; at the apex obtuse, somewhat tapering. Under a strong lens it is seen to be slightly striatulate. Ten slightly convex whorls, the last compressed, obtusely carinate around the umbilicus; suture moderately impressed. Aperture is oblique, subtriangular, subangular below; the peristome strong, reflected, continuous. One very strong, emerging parietal lamella, penetrating very far inward. One strong, thick, transverse columellar lamella situated high. Outer lip having a conic tooth. Three (sometimes 4) slender, short, deeply placed palatal folds, the lowest one punctiform, rudimentary. Length 4½-5, diam. 1½ mm. (*Pollonera*).

Italy: Genoa (type loc.) and its environs; also drift of the upper Scrivia river in Piedmont at monte di Tortona (Pollonera); Rapallo (J. and A. L. Baily); débris of the Torrento di Sturla at Genoa (Flach).

Pupa ligustica Pollonera, Bull. Soc. Malac. Ital., xii, 1886, p. 214, pl. 6, f. 9, 10.—Flach, Verh. phys.-med. Ges. Würzburg, xxiv, 1890, p. 6, footnote 1, as doubtfully distinct from *biplicata*.

The description and figures are from Pollonera. He further notes that

A. ligustica is related to *A. bourguignatiana* Nev., a Menton fossil, but the last whorl is contracted and the aperture somewhat channelled below. It differs chiefly from *A. biplicata* by the strong contraction of the last whorl below, the carina around the umbilicus being far more pronounced; the aperture is longer, more angular below; the peristome more solid and almost continuous, with a stouter tooth. The palatal folds are shorter, slighter, and much more deeply placed.

There are three of these, and perhaps a fourth close to the suture.

A specimen collected by Baily at Rapallo measures: length 3.7, diam. 1.45 mm.; 8½ whorls, being smaller than Pollonera indicates. The heavy but adnate parietal callus is a prominent feature. The parietal lamella is stronger than in *biplicata*.

5. Agardhia biplicata (Mich.). Pl. 16, figs. 1, 2.

Shell lengthened, cylindric, pellucid, glossy glabrous, umbilicate, whitish. Nine nearly flat whorls, the upper ones small, the rest equal. Aperture triangular; columella with one fold, inner lip one fold, outer lip swollen; peristome reflected, white. Apex very obtuse. Length 2½ lines, diam. ¾ of a line (*Michaud*). Michaud adds that there are also two folds within the lateral border of the aperture.

Shell cylindric, umbilicate, pellucid, subglabrous, obtuse at the apex, under a lens slightly striatulate. Whorls 8 to 10, a little convex, the last somewhat compressed at base, obtusely crested around the circular umbilicus; suture deep. Aperture suboblique, subtriangular, rounded below; peristome paler, reflected, interrupted, the margins connected by a callus. One strong emerging parietal lamella, continued very far inward, above it a conic supplemental denticle situated deep within. One columellar lamella strong, transverse, situated high. Outer lip having a conic tooth. Four palatal folds, of which the lower and upper are rudimentary and deep within, the second and third lamelliform and produced towards the margin. Length 4½, diam. 1½ mm. (*Pollonera*).

France: Lyons in débris of the Rhone (Terver, type locality); Alpes-Maritimes; grottes des Pyrénées (Germain). Italy: various places in the Apuan Alps and the adjacent Appenines; post-pliocene of Monte Pisano (de Stefani, 1883). Southern Tyrol: Bolbeno in Judicaria and Castelfondo im Nonsberge (Gredler). Lives in damp places under stones and moss, and in caverns.

Pupa biplicata Michaud, Complément de l'Hist. Nat. Moll. Terr. et Fluv. France de J. P. R. Draparnaud, 1831, p. 62, pl. 15, figs. 33, 34.—PFEIFFER, Monogr. Hel. Viv., ii, 332; iii, 543; iv, 669; vi, 309.—DUPUY, Hist. Moll. France, 1850, p. 406 (in part).—GREDLER, Verh. zool.-bot. Ges. Wien, 1856, p. 110.—DE STEFANI, Bull. Soc. Malac. Ital., ix, 1883, p. 139.—DE BETTA, Atti Istituto Veneto (3), xv, 1870, p. 1462 (provinces Verona and Friuli).—WESTERLUND, Malak. Bl., xxii, pp. 129, 133; Fauna, iii, 1887, p. 89. POLLONERA, Bull. Soc. Mal. Ital. xii, 1886, pl. 6, f. 7.

Sphyradium biplicata Mich., CLESSIN, Moll.-fauna Oesterreich-Ungarns, 1887, p. 243, f. 145.

Coryna biplicata Mich., CECCONI, Boll. Mus. Zool. Anat. Comp. Torino, no. 627, p. 3 (Pianosa).—GERMAIN, Moll. de la France, ii, 1913, p. 183, f. 238.

Among the nearly smooth species, this one is distinguished by the long median palatal folds, the small size of the lip-tooth, the little denticle on the right side of the parietal lamella, and the moderately compressed base.

Michaud's description of this species was incomplete; he did not see all of the teeth. His figure is poor. Dupuy examined and drew Michaud's type, but his account and figures leave much to be desired. Pollonera described and figured a topotype collected by Locard; his work is herein reproduced, as only Italian forms of the species are accessible to me.

As in Pupilla, the length of the shell is individually quite variable, the diameter remaining more constant.

The distribution of *A. biplicata* as given above is subject to revision, since some authors have included various allied forms under that name. The indefinite Pyrenean record appears improbable.

5*a*. *A. biplicata locardi* ('Bgt.,' Loc.). Pl. 16, figs. 10, 11.

Exactly cylindric, a little short and swollen, well rounded at summit, of 7-8 nearly flat whorls, the suture very little impressed. Aperture oval, a little angular at base: 1 median superior fold, long, arcuate, nearly immersed; 1 robust, lamellar, median, oblique columellar fold, nearly reaching to the margin; 3 palatals, the upper and lower rudimentary, the median tubercular on the peristome. Peristome spreading, reflected, a little thickened. Shell glossy, very pale corneous, a little striolate. Length 4½, diam. 1¾ mm. Very rare.

Bief de Saint-Jeannet vallée de Cagne (Alpes-Maritimes). (*Locard*).

Sphyradium locardi Bgt. in LOCARD, Prodr., 1882, without description. *Coryna locardi* Bourguignat, LOCARD, Les Coq. Terr. de France, 1894, p. 325; Ann. Soc. d'Agricult., Sci., Ind. de Lyon, (7), iii, 1895, p. 213.—*Coryna locardi* C. Pollonera, CAZIOT, Mém. Soc. Zool. France, xx, 1907, p. 467, fig. 8.

Locard confused the lip-tooth with the palatal folds. His description is otherwise inexact according to Pollonera (in Caziot: Etude moll. terr. et fluv. Monaco, 1910, p. 336).

This form was collected by Caziot and Pollonera in drift débris of the Loup, a torrent flowing one kilometer west of the Cagne. This specimen is longer than Locard's type, and is thus described by Pollonera:

Shell cylindric, pale corneous, pellucid, very delicately striatulate; 9 whorls, the middle ones a little convex, the rest flattened, the last somewhat compressed basally; suture rather deep. Aperture vertical, oblong, subangular at base; peristome strong, reflexed, interrupted, the margins joined by a very thin callus. Parietal lamella 1, strong; columellar superior, transverse; 4 palatal folds, the upper and lower ones punctiform, deeply placed, the second and third lamelliform, immersed and not parallel. Alt. 4⅗, diam. 1½ mm.

Caziot and Pollonera add that *locardi* differs from *biplicata* by the slightly more convex middle whorls, the straighter aperture with the lip-tooth situated higher, by the absence of the very small upper parietal tubercle, and especially by the two median palatal folds, which are shorter, less parallel to one another, and do not approach so near to the margin of the aperture. In a face view of *biplicata* these folds are readily visible, but in *locardi* they are less apparent and quite noticeably deeper in the cavity of the aperture.

This form is known by very few examples, and its standing as a separate race appears dubious.

5*b*. *A. biplicata pollonerœ* Flach.

A form from Caramico in the Abruzzi is well distinguished by having the parietal and columellar lamellæ very strong, emerging to the peristome, as well as by the very long palatal folds and horn-brown color ([*Coryna biplicata*] var. *pollonerœ* Flach, Verhandl. d. phys.-med. Ges. Würzburg, n. F., xxiv, 1890, p. 7).

5c. *A. biplicata toscaniœ* (Poll.). Pl. 16, figs. 3, 4, 5.

Differs from the typical form by the slightly paler color of the shell, the aperture a little more vertical, by having the callus joining the two margins of the aperture weaker or wanting, by the absence of the supplementary parietal tooth, and by having generally 3, rarely 4 palatal folds. Dimensions as in the typical form (*Pollonera*).

The length of the spire is quite variable as in others of the group.

Italy: Florence in Tuscany and Caramanico, Abruzzo. Post-Pliocene of Tuscany.

Pupa biplicata Issel, Cat. Moll. prov. di Pisa, 1866, p. 22.—Gredler, Nachrbl., xvii, 1885, p. 37 (Florence).—*Pupa toscaniœ* Bourguignat, Moll. tumulus de Nove, in Soc. Sci. Lettr. et Arts de Cannes, iii, 1873 (no description).—*Pupa biplicata* var. *toscaniœ* Bgt., Pollonera, Bull. Soc. Malac. Ital., xi, 1885, p. 212.—*Pupa biplicata* forma 1, *margidens*, Westerlund, Fauna, iii, 1887, p. 89.

This is the middle Appenine race. A specimen is figured from Florence, which may be considered type locality. Probably some north-Italian records of *biplicata* pertain to this race. Length 5, diam. 1.6, length of aperture, 1.5 mm.; 9½ whorls.

Westerlund thus described his forma *margidens:* Outer margin of the aperture less thickened, but with a conic tooth above the middle; border brownish. Florence, in the botanical garden at Boboli.

6. Agardhia excessiva (Gredl.). Pl. 16, figs. 8, 9.

With a third punctiform palatal fold between the lower-palatal and the basal keel, deep within, so that it is scarcely to be seen in the mouth, and a fourth punctiform streak under the suture. It also has a second rudimentary and immersed lamella on the parietal wall, between the principal lamella and the outer lip insertion, and a conic second tooth on the columella, below the principal lamella, and sometimes wanting (*Gredler*).

Differs from the preceding [*biplicata*] by the paler, whitish-yellow shell; vertical aperture; peristome white, the outer margin *not toothed, but a little convex above the middle,* and by generally having another deeply placed lamella on the base of the columella.

Length 4½ to 5, diam. 1½ mm. (*Pollonera*).

Length 4.45, diam. 1.5 mm.; 9 whorls (Trentino specimen).

Southern Tyrol: Castelfondo in the Nonsberge (Herrn Ausserer; type loc.). Italy: Verona and the Friuli in Veneto (Pollonera). Carinthia: Azalla etc. in the Kanaltal (Ressmann, for *ressmanni*). In the Trentino on the outlying Venetian Alps and in the coastal region as far as Malborghet (Kobelt).

Pupa biplicata var.? *excessiva* GREDLER, Verh. zool.-bot. Ges. Wien, 1856, p. 110.—WESTERLUND, Fauna, iii, 1887, p. 89.—*Pupa excessiva* Gredler, POLLONERA, Bull. Soc. Malac. Ital., xii, 1886, p. 213, pl. 6, f. 5, 6.—*Pupa ressmanni* var. *biplicata* Villa, RESSMANN, Nachrbl. d. m. Ges., Nov. 1876, p. 132 (name and localities; no description). *Cf.* GREDLER, Nachrbl., 1877, p. 4.—*Pupa ressmanni* Villa of some authors. —*Pupa grimmeri* Parr. (undescribed) is probably the same, according to Gredler, Nachrbl. 1877, p. 4.

Though describing it as a variety of *biplicata*, Gredler thought *excessiva* a separate species, a conclusion supported by the material before me. Pollonera considered it perfectly distinct specifically from *biplicata* on the grounds that the difference between these two species is not only in the diminution of the tooth of the outer lip of *excessiva*, but also in its position, for whilst the tooth of *P. biplicata* is little above the middle and opposite the columellar lamella, the slight swelling which represents the tooth in *P. excessiva* is situated quite noticeably higher, at the height of the parietal lamella. He points out that weakness of the lip-tooth is a character of the eastern species related to *biplicata*, whilst in those of the west (Italy, France) this tooth is strong.

The figures of Pollonera are here reproduced. In some examples the lip-callus is less prominent.

7. Agardhia bielzi (Rossm.). Pl. 16, figs. 12, 13, 14.

Shell rimate-perforate, cylindric, apex obtusely rounded, corneous-buff, very finely striate-costulate, rather glossy. Nine very slowly increasing whorls, a little convex, the last a little wider, slightly compressed basally. Aperture oblong-semiovate, subvertical, 5-toothed: one strong lamelliform tooth on the parietal wall, three in the palate (the middle one elongated fold-like), one on the columella. Peristome reflected, thin, very weakly thickened within and colored liver-brown; margins subparallel, straightened, the outer curving inward above and then somewhat impressed. Length 5½, diam. 2 mm. (*Rossm.*).

Length 5, diam. 1.9 mm.; 8¼ whorls. Rodna Mts. Figs. 13, 14.

Length 5, diam. 1.6 mm.; 10 whorls. Brosteni, Moldavia.

Length 5.4, diam. 1.7 mm.; 8½ whorls. Brosteni, Moldavia. Fig. 12.

Length 4.55, diam. 1.8 mm.; 8 whorls. Rodna; var. *euodon*. Figs. 15, 16.

Transylvania: the village Nagy Falu, near Bethlen (Bielz, type loc.); from the Rodna over the Gyergyo and Hargita Mts. to the Barot Mts. at Bad Keroly (Kimakowicz); Brosteni in the Moldavian Carpathians (A. Montandon). Also northward to the Galician Tatra (var. *euodon*).

Pupa bielzi Rossmaessler, Iconographie Land u. Süsswasser-Mollusken Europa's, iii, 1859, p. 109, pl. 85, f. 942.—*Sphyradium bielzi* Rm., Clessin, Fauna Oesterreich-Ungarns, p. 245, f. 146. — *Coryna bielzi* Rm. Kimakowicz, Verh. u. Mittheil. Siebenb. Ver. Nat. Hermannstadt, xl, 1890, p. 101.—*P. biplicata* Mich. Bielz, Vorarbeiten zu einer Fauna der Land- und Süsswasser-Mollusken Siebenbergens, in Verh. u. Mitth. siebenbürgischen Vereins für Naturwiss. zu Hermannstadt, xii, 1861, p. 51, and Fauna, 2te Aufl., 1867, p. 96 (northern Transsylvania at Czaki-Gorbo, Apa-Nagyfalu near Bethlen, Rodna, Gorgény-Szent-Imre, Gyergyo-Toplitza, Borszék, Balanbanya and Bad Keroly; under bark of old trunks and fallen leaves and wood on the ground).

A. bielzi lacks the distinct tooth in the outer lip which characterizes *A. biplicata* and its allies, in this respect standing nearer to *excessiva;* but it differs from both by the fine, thread-like striæ. These gradually disappear on the last whorl, the last fourth being very glossy and nearly smooth. The short basal fold is so far in that it is generally not visible in a direct front view. The lower-palatal fold is moderately long, running forward into the callus within the lip. The upper-palatal is quite short. Typically there is but one lamella on the parietal wall, but in the form *euodon* a small tubercular angular lamella stands far within near the parietal lamella.

Kimakowicz notes that "the young stage of this species is like that of *Orcula doliolum* except that it has no folds or lamellæ, these being only developed in the completed shell. The gimlet-hole shaped umbilicus of the earlier whorls is closed after the end of the sixth whorl. The smallest full-grown example of my collection was collected by Dr. Jickeli at Bad Borszek. It has the dimensions: height 4.5, diam. 1.7 mm., 8½ whorls. The largest, taken by Dr. Petri from Schässburg and Korongyis in the Rodna Mountains, height 6.7, diam. 1.7 mm., 11 whorls. The diameter has been given by all authors too large. Of the many shells before me, none reaches a diameter of 2 mm., but at most 1.8 mm."

Kimakowicz further notes that the form *euodon* West. is sometimes found in Transsylvania. The very small subcolumellar tooth and the small denticle between parietal lamella and suture are often present. But everywhere the characters of the typical form predominate, so that he does not count var. *euodon* of Upper Hungary and Galizia as a member of the Transsylvanian fauna.

A. bielzi euodon (Westerlund), pl. 16, figs. 15, 16, is described as having two parietal teeth, the outer one small, thin, deeply placed; two on the columella, the upper long, strong, the lower tooth-shaped; three in the palate, the upper one lengthened, the third wart-like. The palate often has a reddish-white or whitish callus. Length 5 to 7, diam. 2 mm. Galicia at Prezmysl and in the Tatra, Kotula (*Pupa bielzi* var. *euodon* Westerlund, Fauna, iii, 1887, p. 89).

This is a northern race of Galicia and the Tatra range, but specimens with the same characters occur sporadically in

Transsylvania, the territory of typical *bielzi,* as noticed by Kimakowicz, and found in a lot before me from the Rodna Mts., one of which is drawn in pl. 16, figures 15, 16. It seems, therefore, hardly worth recognition as a subspecies.

7*a*. *A. bielzi romanica* (Kim.).

Striation of the shell much finer and less distinct. Columellar lamella placed very high, but little emerging and decidedly obsolete. Parietal lamella rudimentary, scarcely indicated. The lowest palatal [basal] fold is wanting, the two others are markedly weaker than in the type form. Length 4.6, diam. 1.6 mm., 8½ whorls (*Kim.*).

Southern slope of the Transsylvanian Alps south of the Tömöser Pass in Rumania and spreading over the Kronstadt and Bodza Mountains.

Pupa (*Sphyradium*) *biplicata* CLESSIN, Malak. Blätter (n. F.), viii, p. 166.—*Coryna bielzi* var. *romanica* KIMAKOWICZ, Verh. u. Mittheil. Siebenbürgischen Vereins f. naturwissenschaften in Hermannstadt, xl, 1890, p. 101.

Subgenus AGARDHIELLA Hesse.

Agardhiella Hesse, Archiv f. Molluskenkunde, lv, 1923, p. 195; for "die Sippe der *A. truncatella.*"

Agardhias in which there are *no palatal folds;* outer lip tooth, parietal and columellar lamellæ may be either present or wanting; when an angular lamella is present it emerges near the termination of the outer lip. The embryonic 1⅔ whorls are microscopically wrinkle-pitted, after which axial riblets abruptly set in. Type *A. truncatella.*

These forms occur from the Friuli to Transylvania and at least as far south as Philippopolis in Rumelia. The species and races seem to be somewhat numerous, but outside of Austrian and Transylvanian collections, specimens are still rather scarce. The local races have been little understood, but Kimakowicz, Hesse, and especially Sturany and Wagner, have worked most of them out satisfactorily.

8. Agardhia macrodonta Hesse. Pl. 18, figs. 4, 5.

Differs from *A. lamellata* Cless. by the shell smaller and more slender throughout, with rather more widely spaced, less raised riblets which also appear to be less oblique. The aperture is a little less contracted by the lamellæ and folds, though these lamellæ and folds are individually variable as in all forms of this group. The always strong and high parietal lamella is straight (not bent S-shaped, as in *A. lamellata*). A tooth in the middle of the outer margin is strongly developed also in this species, but the outside is less impressed at the position of the tooth. On the columella there is a strong tooth opposite, below it another fold-like, more or less obsolete one. Likewise there are traces of weak folds in both angles of the aperture. The peristome is sometimes shortly free. The outer margin is straight and thin in its upper half, thickened and expanded outward in the lower half from the tooth down. Two well-preserved specimens are before me. Height 3.8 and 4.2 mm., diam. 1.2 and 1.5 mm. (*Hesse*).

Eastern Rumelia: débris of the Maritza at Philippopolis.

Agardhia lamellata Cless., Hesse, Nachrbl., vol. 45, 1913, p. 9.—*Agardhia macrodonta* Hesse, Nachrbl. D. M. Ges., vol. 48, 1916, p. 116.

This is the form which I formerly took to be *Ag. lamellata* Cless. Subsequently I received from Herrn Oberstabsarzt Dr. Wagner the Transylvanian *A. lamellata* from the original locality, Kerczsora im Fogaraser Gebirge, and satisfied myself that my Rumelian form is sufficiently distinct from it to pass as a separate species (*Hesse*).

The two specimens at present known, which have been lent me for illustration, represent two rather diverse forms, which require separate notice, though it may possibly turn out that they are connected by intermediate forms. Hesse's description translated above covers both.

Typical *A. macrodonta* Hesse. Pl. 18, figs. 4, 5.

Diameter one-third the length. About 15 riblets in one mm. on the face of the last whorl, less oblique than in *A. lamellata*. Parietal lamella straight; without distinct accessory lamellæ on the parietal wall. Columellar margin irregularly thickened; columellar lamella deeply placed, vertical, bilobed, the lower lobe projecting more. Tooth of the outer lip more massive than in *A. lamellata*. No basal fold. Length 4, diam. 1.35 mm.; fully 7 whorls.

8*a*. *A. macrodonta gracillima* n. subsp. Pl. 18, figs. 6, 7.

Diameter less than one-third the length. Rib-striæ closer, about 22 in 1 mm. on face of the last whorl. Small folds in both upper angles of the aperture. Columellar lamella a simple lobe, steeply ascending spirally. In the massive outer tooth and absence of a basal fold it is like typical *macrodonta*. Length 3.8, diam. 1.1 mm.; slightly over 7 whorls.

While this form occurred in river drift with *macrodonta*, it is quite likely that they were washed down from different stations.

9. Agardhia rumelica Hesse. Pl. 18, figs. 8 to 12.

Differs from the type [of *macrodonta*] by the decidedly weaker dentition as well as the closer, finer and still less oblique riblets. In the middle of the parietal wall a strong, straight lamella; the tooth of the outer margin much weaker than in the type, the outer wall less impressed. Columella sometimes quite smooth, sometimes with one or two low folds, the lower one generally on the base of the columella. Seven to eight whorls. Size very variable; of 13 examples before me, the largest measures, 4.9 : 1.5 mm., the smallest 3.7 : 1.4 mm. (*Hesse*).

Rumelia: débris of the Maritza at Philippopolis.

Agardhia armata Cless., Hesse, Nachrbl. D. Malak. Ges., vol. 45, 1913, p. 9.—*Agardhia macrodonta rumelica* Hesse, Nachrbl., vol. 48, 1916, p. 117.

This is the form which I erroneously called *Ag. armata* in my former work. In *Ag. parreyssi* the parietal lamella is very low and weakly developed, the rib sculpture of the shell is almost vertical; outer lip and columella are very weakly toothed (*Hesse*).

Plate 18, fig. 8, the largest example of thirteen, 4.8 mm. long, 1.4 wide, with 8 whorls, may be considered type of this form, which at present does not appear to intergrade with

A. armata, A. biarmata or *A. macrodonta.* There are 16 rib-striæ in 1 mm. on the face of last whorl. These appear slightly less oblique than in *A. macrodonta.* The aperture has a moderately developed columellar lamella, not emerging quite to the peristome, and a well-developed subcolumellar. The lip-tooth projects more than that of *biarmata*, but it is rather slender, not massive as in *macrodonta.* The summit is hemispherical, and the diameter is about equal in the last 5 whorls.

Other specimens are shorter, of 7 whorls. The aperture either as described above, or it has three lamellæ on the columella and an accessory lamella on the parietal wall near the left angle. The general shape differs perceptibly, as the spire tapers a trifle upward. Length 4.2, diam. 1.5 mm.; 14 rib-striæ in 1 mm. on face of the last whorl (pl. 18, fig. 7).

In still another form there may be only a small subcolumellar lamella on the columella (pl. 18, fig. 11), or it may lack lamellæ completely (pl. 18, fig. 10). In either case, a more or less deeply immersed columellar lamella is visible in an oblique view in the mouth.

10. AGARDHIA LAMELLATA (Clessin). Pl. 18, figs. 13, 14.

Having a lamella on the parietal wall considerably lengthened inward, with a fold in the left upper angle of the mouth, with a denticle on the left side of the basal margin (in the corner below the columellar plate), and with a tooth-like, thickened impression of the outer margin (*Bielz*).

The shell is rimate but not deeply, cylindric, rather slender, grayish white, slightly translucent, of 7 whorls, the last 3 or 4 flattened, with moderately impressed suture, the last whorl not ascending in front. Sculpture of fine, sharp, closely set, distinctly oblique rib-striæ. The narrow aperture is shaped somewhat like the figure 8. Below the middle the peristome is well expanded. There is a strong but rather short parietal lamella and a small, short lamella near the left upper angle of the mouth, both emerging to the edge of the thin but distinct parietal callus. On the columella there is a small projection above, and a long, obliquely ascending, entering columellar lamella, rather deeply placed. The outer lip arches forward and is impressed in the middle, with a pit outside and a strong tooth projecting well into the aperture. There is a tubercular basal fold near the base of the columella.

Length 4.8 to 5, diam. 1.6 mm.

Transsylvania: above the glass-house of Kerczesoara (Kercsesora) in a beech wood on the left bank of the brook, under rotten wood on the ground (Bielz, type loc.).

Pupa truncatella BIELZ, Verh. u. Mitth. Siebenbürgischen Ver. Naturwiss. Hermannstadt, xiv, 1863, p. 228.—*P. truncatella* var. *e*, BIELZ, Fauna Land- u. Süsswasser-Moll. Siebenbürgens, 1867, p. 98.—*Sphyradium parreyssii* var. *lamellata* CLESSIN, Molluskenfauna Oesterreich-Ungarns etc., 1887, p. 248.—*Coryna lamellata* Clessin, KIMAKOWICZ, Verh. u. Mitth. des Siebenbürgischen Ver. Nat. Hermannstadt, 39 Jahrg., 1889, p. 99.—*Agardhia lamellata* Cless. STURANY and WAGNER, Denkschr. math.-wiss. Kl. Akad. Wissensch. Wien, Bd. 91, 1914, p. 66, pl. 18, f. 107.

This species is well distinguished by its narrow aperture, with the tooth of the outer lip large and projecting strongly, the columellar lamella also strongly developed, and by having a *distinct basal fold.*

Clessin evidently had not seen the species, merely naming Bielz's "*P. truncatella* var. *e*," and copying that author's description; but very good descriptions have been published by Kimakowicz and by Sturany and Wagner, who gave the figure reproduced in my pl. 18, fig. 14. Fig. 13 is from a topotype in the Hesse collection.

Bielz states that "the animal is white, nearly transparent, with flesh-colored liver. When extended the foot is 2½ lines long, ⅓ line wide, and has very long (1 line) and relatively thick tentacles without terminal knobs, and which, on repeated observation in the brightest light showed no eye-spots." These specimens were found in autumn under about 6 inches of forest débris, near Kerczesoara, in the neighborhood of the Bullabach locality near the Glashütte formerly given for the same form, var. *e*. The country rock is mica-schist; other Transsylvanian stations for the *P. truncatella* [group] being on limestone.

II. AGARDHIA PARREYSSII ('Friv.', Pfr.). Pl. 18, figs. 15, 16.

Shell rimate-perforate, cylindric, slender, thin, longitudinally closely costulate, diaphanous, whitish, the apex very obtuse. Whorls 7-8, flat, the lower ones rapidly increasing, the last one-third of the total length, somewhat compressed at base. Aperture oblong, dilated basally, with one entering fold on the parietal wall, another obsolete one on the upper part of the columella. Peristome simple, scarcely expanded, toothless, the margins joined by a callous lamina. Length 5⅔, diam. 1¾ mm., aperture 1¾ mm. long (*Pfr.*).

Length 5, diam. 1.6 mm.; 7 whorls (Sturany and Wagner).

Length 4.6, diam. 1.6 mm.; 15 striæ in 1 mm. on face of last whorl.

Length 5.3, diam. 1.7 mm.; 7 whorls; 15 striæ in 1 mm. on face of last whorl.

Turkey (Pfr.). Transsylvania: Upper Lapugy Valley near Dobra, and in woods above Govasdia on the foot of the Kacsanyas near Vayda-Hunyad in the Hálszeg Mts. (Kimakowicz). Bazias in the Banat (Dr. Wagner). Western Transsylvania, Banat, Servia eastward of the Morava and Bulgaria (Sturany and Wagner).

Pupa parreyssii Friv. in sched., PFEIFFER, Monogr. Hel. Viv., ii, 1848, p. 311.—WESTERLUND, Fauna, iii, 1887, p. 88.

? Sphyradium parreyssii Pfr., CLESSIN, Molluskenf. Oesterreich-Ungarns, 1887, p. 246, f. 147.

Coryna parreyssi Pfr., KIMAKOWICZ, Verh. Mitth. Siebenb. Ver. Nat., vol. 40, 1890, p. 99.—*Agardhia parreyssii* Pfr., STURANY & WAGNER, Denkschr. etc., vol. 91, 1914, p. 65, pl. 18, fig. 106.

Pupa truncatella Pfr. BIELZ, Verh. u. Mitth. siebenbürgischen Vereins f. Naturwiss. zu Hermannstadt, xii, 1861, p. 51; xiv, 1863, p. 228 (living animal); Fauna der Land- und Süsswasser-Mollusken Siebenbürgens, 2te Aufl., 1867, p. 97.

Pupa truncatella var. *d.* BIELZ, Fauna Land- und Süsswasser-Moll. Siebenbürgens, 2te Aufl., 1867, p. 98.—*Sphyradium parreyssii* var. *armata* CLESSIN, Molluskenfauna Oesterreich-Ungarns, 1887, p. 247, fig. 148.—*Coryna p.* var. *armata* Cl., KIMAKOWICZ, Verh. Mitth. Siebenb. Ver. Nat., vol. 40, 1890, p. 99.—*Pupa parreyssi* var. *cæsa* WESTERLUND, Fauna

Europæa Moll. extramar. Prodromus, fasc. ii, 1878, p. 188.—*Coryna parreyssi* var. *cæsa* WEST., Synops. Moll. extramar. Reg. Palæarct., 1897, p. 73.—KIMAKOWICZ, Verh. Mitth. Siebenb. Ver. Naturwiss., vol. 40, 1890, p. 99. — ? *Sphyradium parreyssii* var. *cæsia* CLESSIN, Molluskenfauna Oesterreichreich-Ungarns, 1887, p. 247.

''It is distinguished from all forms of *A. truncatella* by the flattened, more rapidly increasing whorls, parted by a scarcely impressed suture, and the hair-fine, vertical rib-striæ; also the aperture appears less contracted below, therefore not of a rounded triangular shape, but approaching semi-ovate.

''Pfeiffer described this species as toothed, so that Clessin's var. *armata* seems to be superfluous. The relations of breadth of the last two whorls are pretty variable, and differ in examples from the same place, so that the var. *cæsa* Wstld. is also to be set down as an individual variation'' (*Sturany and Wagner*).

This species was included under *P. truncatella* by Bielz, who described five varieties of that species, thus:

a. Aperture entirely unarmed. Govasdia and on Mt. Kaczanyas at Vajda-Hunyad.

b. A fold in the left upper corner of the aperture, at the confluence of parietal with columellar margin. At the Csetate boli cavern in the Schieltal.

c. On the parietal wall a small lamellar tooth. This variety from Turkey not found in Siebenbürgen. [This refers apparently to Kuester's pl. 4, figs. 24, 25.]

d. Upon the parietal wall a lamellar tooth, and a fold in the right and left angles; further, there is sometimes a denticle on the columella and also an impression of the outer lip, thickened tooth-like. [This form was subsequently named var. *armata* Clessin.]

e. [This was later named var. *lamellata* Clessin, see no. 10.]

Clessin's figure of his var. *armata* is reproduced in pl. 19, fig. 1. It has been reported from Transylvania: Mt. Mogura near Bar and on the Piatra Sipotului at Petrosz (Bielz); Piatra Zenoga in the Schiel Mts. and on the Piatra Sipotului and the Piatra Barului in the Strell Mts. (Kimakowicz).

The var. *cæsa* Westerlund was thus described: ''Shell slender, the last and penult whorls of equal width, columellar margin of the aperture having a rather deep incision above before its insertion. Length 5½, diam. 1½–1⅔ mm. Banatus, Kuester coll.''

In Westerlund's latest account he says: ''Ap. margine exter. superne incisura profundiuscula munita,'' where before he had said ''margine columellari.'' Also in the German text (1887) he said: ''Aussenrand oben ziemlich tief ausgebuchtet.'' This is the condition in all of the group, so that his first statement was apparently an error. Nothing was said of teeth, which presumably are as described by him for the typical form, 1-2 slender parietal, and 1 columellar lamella.

Sturany and Wagner do not consider *armata* and *cæsa* to be valid races.

12. Agardhia stenostoma (Flach).

Shell rimate, narrow, cylindric, at the apex obtuse, narrowly costulate, similar in stature to *parreyssii*, a little smaller. 6½ slightly convex whorls. Differs primarily by having the neck before the aperture very strongly and abruptly constricted as far as the sinulus; the aperture is very narrow, strongly oblique, outwardly sinuate; outer lip simply expanded; 3 parietal folds, the middle one prominently arcuate. Length 4.2, diam. 1.2 mm. (Flach).

Dalmatia. One example in the Boettger coll.

C.[*oryna*] *stenostoma* Flach, Verhandl. d. phys.-med. Ges. Würzburg, n. F., xxiv, 1890, p. 5, footnote 2.

This unfigured form has not been noticed by subsequent authors.

13. Agardhia truncatella (Pfr.). Pl. 19, figs. 2, 3, 4, 5.

Shell rimate, cylindric, obtuse at apex; thin, diaphanous; vertically elegantly costulate; waxy whitish; 6 to 7 rather flattened whorls, the last rotund basally, slightly over a fourth of the total length. Aperture subvertical, obliquely semioval, toothless; peristome nearly simple, a little reflected, the right margin arching forward, columellar margin shorter. Length 4; diam 2 mm.; aperture 1⅓ mm. long (*Pfr.*).

The peristome is very narrow and slightly thickened within; the outer margin weakly impressed in the middle, with a weak to indistinct tooth-like callus within. Lamellæ and folds are nearly always lacking on the parietal wall and columella; only in occasional examples weak, short folds can be seen at the inner angle of the aperture or in the middle of the parietal wall. Length 4, diam. 1.6 mm., 6½ whorls (*Sturany and Wagner*).

Eastern outliers of the Alps in Steiermark (south of the Semmering), Kärnten, Krain, Küstenland, Istrien, Kroatien, Bosnien; only in the valley region, and always found subterranean or in caverns (Sturany & Wagner). Mt. Karst, Castelnuovo, between Triest and Fiume (Pfr., type loc.). Drift of the Save at Laibach (Schmidt); lower Dalmatia (Neumeyer). Carinthia, Satnitz near Klagenfurt. Grosskahlenberge near Laibach, on the Nanos and Golove, at Glince, Ursanica and Weichselburg in Krain; in the mountainous region of the Friaul, in the upper Trebusa valley and on the Alp Gozdec (Clessin). Tanneben, back of Peggau, near Graz and near Frohnleiten, Steiermark (Tschapeck, Nachrbl., 1885, p. 18). Kapellagebirge in southern Croatia (Reitter).

Pupa truncatella PFEIFFER, Symbolæ ad Hist. Helic., i, 1841, p 46; Monogr. Hel. Viv., ii, p. 303.—KUESTER, Conchyl. Cab., *Pupa*, p. 34, pl. 4, f. 20, 21; Ber. nat, Ges. Bamberg, ix, 1870, p. 100 (Triest and Cattero, those from Cattaro more slender, less sharply rib-striate.—ROSSMAESSLER, Iconogr., ii, pt. xi, 1842, p. 12, pl. 53, f. 733. — DE BETTA, Atti Istituto Veneto (3), xv, 1870, p. 1462 (Prov. Friuli).—WESTERLUND, Malak. Bl., xxii, 1875, p. 135; Fauna, iii, 1887, p. 88.—HIRC, Verh. zool.-bot. Ver. Wien, xxx, 1880, p. 527 (Lukvodol, Liburnischen Karst).—*Pupa* (*Sphyradium*) *truncatella* Pfr., BOETTGER, Nachrbl., 1882, p. 179 (Moräutscher Grotten, Ober Krain, *Stussiner*). — *Agardhia* (*Agardhia*) *truncatella* Pfr., STURANY & WAGNER, Denkschr. Math.-Wiss. Kl. K. Akad. Wissensch., Bd. 91, 1914, p. 64, pl. 18, f. 102 (good).—*Pupa intermedia* Kokeil, GALLENSTEIN, Jahrbuch des naturhistorischen Landesmuseums von Kärnten, i, 1852, p. 78, in the synonymy of *Pupa truncatella* Pfr.

"This species is distinguished from the form-series of *A. parreyssii* (Pfr.) by the more strongly convex, more slowly increasing whorls, parted by a deeper suture, as well as by the stronger, more widely-spaced and distinctly oblique rib-striæ; whilst the apertural characters of both species are very similar and equally variable'' (*Sturany and Wagner*).

Kuester's figure is photographed in our fig. 5; but it is rather poor. A typical specimen from Carinthia (fig. 2) measures, length 3.9, diam. 1.6 mm., 6½ whorls, 12 riblets in 1 mm. on the face of the last whorl. Another having a fold in the left upper angle, and a stronger lip-callus (figs. 3, 4), measures 3.6 x 1.55 mm., and has 10 to 11 riblets in 1 mm.

13*a*. *A. truncatella formosa* ('Parr.' Pfr.). Pl. 19, figs. 6, 7, 8.

Larger, more finely costulate; 8 whorls; outer margin of peristome impressed outside. Length 5½, diam. 2 mm. (*Pfr.*).

Larger, more slenderly cylindric, with 7 to 8 whorls and three folds on the parietal wall, of which the median one is raised lamella-like, and penetrates far within. Length 5 to 5.5, diam. 2.6 mm. (*Sturany and Wagner*).

Ragusa and Castelnuovo, in southern Dalmatia (Sturany and Wagner).

Pupa truncatella KUESTER, Conchyl. Cab., pl. 4, f. 22, 23. —*Pupa formosa* Parr. in sched., PFEIFFER, Monogr. Hel. Viv., 1848, ii, 304 (as a var. *b* of *Pupa truncatella*). — *Agardhia* (*Agardhia*) *truncatella formosa* Pfr., STURANY and WAGNER, Denkschr., vol. 91, 1914, p. 65, pl. 18, f. 103.

The figures of Kuester (pl. 19, figs. 6, 7) and that of Sturany and Wagner (fig. 8) are reproduced.

13*b*. *Agardhia truncatella biarmata* (Boettg.). Pl. 19, figs. 9 to 14.

Shell more slender than the type [of *truncatella*], distantly costulate; aperture with a distinct parietal lamella and armed with a large callous denticle in the middle of the outer margin; callus joining the margins denticulate. Length 3⅝, diam. 1½ mm. (*Bttg.*).

Dalmatia: Ragusa and Pridworje, very scarce (Reitter). Cavern near Zavala (but not the well known ''Windloch''), Hercegovina (G. Paganetti-Hummler, 1903).

Pupa (*Sphyradium*) *truncatella* var. *biarmata* O. Boettger, 19r.–21r. Bericht Offenbacher Vereins f. Naturkunde, 1880, p. 109.—*Coryna biarmata* Bttgr., Sturany, Nachrbl. D. M. Ges., vol. 36, July 1904, p. 105, text-figs. — *Agardhia* (*Agardhia*) *truncatella biarmata* Bttg., Sturany and Wagner, Denkschr., vol. 91, 1914, p. 65, pl. 18, f. 104*a-c*.

Dr. Sturany has given figures (which we reproduce in pl. 19, figs. 11, 12) and the following notes on this species:

> The cylindric, stab-like umbilicate, pale yellow colored shell consists of 7 whorls, of which the first 2 to 2½ are smooth, the rest provided with numerous transverse riblets, placed a little obliquely. In shape, sculpture and build therefore agreeing with *P. truncatella* Pfr.; but distinguished principally from this form by the dentition of the aperture. There is here one tooth on the outer margin and a lamella on the parietal wall. The margins of the peristome are connected by a parietal line on which the riblets of the preceding whorl end button-like. The outer margin as well as the columellar margin is arcuate and curved forward. The columella has 2 or 3 little teeth deep within, which stand on a projecting welt and are thus visible in an oblique view in the mouth. Length of the shell 4, breadth 1.7 mm.
>
> Dr. Boettger was so good as to bring *Pupa truncatella* var. *biarmata* Bttgr. to my attention and intrust to me one of his original specimens for comparison, so that I could convince myself of their identity. I publish here the new locality, and at the same time follow Boettger's hint in understanding *biarmata* as a separate species, no longer a variety of *truncatella*.

In the last consideration of *biarmata*, by Sturany and Wagner, it is ranked as a subspecies of *truncatella*. The apertural armature is said to be variable: there are generally three rather short dentiform folds on the parietal wall, but sometimes the two outer ones are lacking, sometimes some may be doubled. On the columella there are 1, 2 or 3 folds, which likewise become indistinct sometimes (figures 9, 10, reproduced from S. & W.).

The specimens I have seen, pl. 19, figs. 13, 14 (from Komeno near Castelnuovo, Dalmatia [Hesse coll.]), appear to differ constantly from *A. truncatella* by the more distinctly developed lip-tooth, though agreeing with that form in sculpture.

13*c*. *Agardhia truncatella skipetarica* A. J. Wagner. Pl. 19, fig. 15.

Shell more slenderly cylindric, extremely closely and finely rib-striate; the aperture is wholly toothless, its outer margin weakly impressed. Length 4, diam. 1.4 mm. (*Wagner*).

Zabljak in Montenegro; Kiribrücke close to Mesi, near Skutari, Albania (Sturany, 1905).

Agardhia (*Agardhia*) *truncatella skipetarica* A. J. Wagner, STURANY and WAGNER, Denkschr. math. nat. Klasse k. Akad. Wissenschaften, Bd. 91, 1914, p. 47, pl. 18, f. 105.

By its close and fine rib-striation this form approaches a toothless form of *A. parreyssii* remarkably. The oblique direction of the striæ as well as the more slowly increasing, distinctly convex whorls allow it to be recognized as a form of *A. truncatella* (*S. & W.*).

Subfamily PAGODULININÆ.

This subfamily is provided for the reception of *Pagodulina* and *Spelæodiscus* (*Aspasita*), genera which cannot well be included in the Pupillinæ or the Orculinæ on account of their rather peculiar shells. It is a provisional expedient which may serve until the affinities of these groups shall be worked out.

The species are illustrated on plates 20 to 22.

Genus PAGODULINA Clessin.

Pagodina STABILE, Moll. terr. viv. Piémont, Atti Soc. Ital. di Sci. nat., Milano, vii, 1864, p. 100, for *Pupa pagodula*. Not *Pagodina* VAN BENEDEN, Bull. l'Acad. Roy. Sci., Lettr. Beaux-Arts de Belgique, xx, pt. 1, 1853, p. 482 (Crustacea).

Pagodulina CLESSIN, Deutsche Excursions-Mollusken-Fauna, 1876, p. 198, a "gruppe" for *Pupa pagodula* only.

Pagodula HESSE, Nachrbl. D. M. Ges., v. 48, 1916, p. 124, new name for *Pagodina* Stabile. Not *Pagodula* MONTEROSATO, Nomencl. Generica e Specifica Conchiglie Mediterranee, 1884, p. 116 (*Muricidæ*).

The shell is oblong or cylindric, imperforate but deeply and very openly rimate (the young stages perforate), of about 8-9 convex whorls, the last strongly ascending; rib-striate, after the microscopically pitted 1½ embryonic whorls. Aperture having a reflected lip, the outer margin bent in and often thickened in the middle, otherwise toothless. An obliquely descending columellar lamella, a long palatal fold and a spiral lamella above are within the ventral side of the last whorl. The animal has very short lower tentacles and carries the shell horizontally.

Type *P. pagodula* Desm. Distribution, southern and eastern Alps and adjacent mountainous regions; Caucasus.

Palæontology.—The single species described from the Upper Pliocene is a typical *Pagodulina* with strongly developed palatal fold and lip-thickening.

PAGODULINA BELLARDII (Sacco). *Pupa bellardii* Sacco, Nuove sp. foss. Moll. lac. terr. in Atti R. Accad. Sci. Torino, xix, 1884, p. 353, pl. 8, f. 12; Mem. R. Accad. Sci. Torino, Cl. Fis. Mat. e Nat. (2), xxxvii, p. 198, pl. 2, f. 5*a-b*.—*Pagodina bellardii* Sacco, I Moll. terr. terz. Piemonte e Liguria, pt. xxii, 1897, p. 69, pl. 6, f. 2, 3. Upper Pliocene, Astien: Fossano.

O. Reinhardt has stated that *P. pagodula* has no lamellæ or folds in the young stages (Jahrb. D. M. Ges., 1877, p. 281; Nachrbl., 1914, p. 74). The young shell has an open, perspective umbilicus, so that the shell of 3 or 4 whorls looks like a miniature *Solarium*. The internal folds of the adult stage are formed only on completion of the last whorl. In *P. subdola* I find a stout but deeply immersed prominence on the columella (pl. 21, fig. 4), but no other lamellæ or folds in immature shells of 6½ to 7 whorls.

Pagodulina has generally been understood to contain only one Recent species, *P. pagodula*, with several named varieties. Aside from the unfigured and little known *P. bourguignati* Cout., not seen by me, and of uncertain status, the series examined appears divisible into three species: (1) the common *P. pagodula;* (2) the Caucasian *P. lederi,* well distinguished by its close, fine sculpture; (3) *P. subdola* of the eastern and southern Alps and their outliers, distinguished from both of the preceding by the presence of a lower-palatal fold, ventral in position, below the usual long palatal fold.

The following named forms are not known to me by specimens: *P. pagodula austeniana* Nev., possibly a form of *subdola,* but the internal structure is unknown. *P. tchapecki* Gredl., possibly pathologic; *P. pagodula* var. *adaucta* de Betta, insufficiently defined. These several forms have not been observed by any other authors since their description.

Key to Species and Chief Varieties of Pagodulina.

1 Length 1.4 mm. *P. bourguignati,* no. 4.
Length 3 mm. or more (2).

2 Having a short lower-palatal fold below the long palatal fold within the ventral side of the last whorl (3).
No lower-palatal fold below the long one (5).

3 A suprapalatal fold above the long median one, 3 palatals in all. *P. subdola adamii,* no. 2*c*.
No suprapalatal fold, there being only two palatals (4).

4 Shape and sculpture about as in *P. pagodula,* the riblets being spaced, becoming close on the last half-whorl. *P. subdola,* no. 2.
More slender, the riblets remaining well spaced on the last half-whorl. *P. subdola gracilis,* no. 2*d*.

5 Riblets rather widely spaced, 6 to 10 in 1 mm. on the face of penult whorl; Europe (6).
Riblets closely crowded throughout, about 15 in 1 mm. on face of penult whorl; Caucasus region. *P. lederi,* no. 3.

6 About 8½ whorls, little more than the last one exposed in the closed, J-shaped umbilical cavity (7).
10 whorls, 4 mm. long, the penult whorl exposed in the round umbilicus. *P. s.* form *tschapecki,* no. 2*a*.

7 Riblets well spaced, becoming decidedly closer on the last half-whorl. *P. pagodula,* no. 1.
Riblets remaining well spaced on the last half-whorl. *P. pagodula sparsa,* no. 1*b*.

1. PAGODULINA PAGODULA (Desm.). Pl. 20, figs. 1 to 4.

The shell is imperforate but with a long, deep, J-shaped basal suture, cylindric-oblong, cinnamon-buff, with little luster. The whorls are quite convex to the last, which is *impressed around the middle;* its last half is straightened and *ascends steeply* across the penult whorl, almost to the preceding suture; the base being rounded. The first 1½ whorls appear smooth (but are microscopically very densely pitted), subsequent whorls ribbed, the ribs straight, retractive, hardly one-fourth as wide as their intervals, about 7 to 10 in 1 mm. on the face of the penult whorl, microscopic striæ between them; *on the last half of the last whorl they become crowded,* the intervals hardly more than half as wide as before. The aperture is somewhat oblique, the lower margin being advanced, in shape indistinctly triangular. The peristome is brown-tinted, reflected; the outer margin is bent in and thickened inwardly above the middle, the parietal margin is typically a little raised, continuous (but often is adnate); columellar margin concave, reflected. The cavity of the last whorl, in its first half, is narrowed by a strong, obliquely descending columellar plate, reaching to the basal wall, a strong and long palatal fold, and a smaller but long spiral lamella on the upper wall.

Length 3.85, diam. above aperture 1.85 mm.; 8½ whorls. Provence.

Length 3.5, diam. above aperture 1.85 mm.; 8½ whorls. Grenoble.

Length 3.3, diam. above aperture 1.8 mm.; 8½ whorls. Marseilles.

Southern France, from Dép. Dordogne (near the chateau of Lanquais à trois lieues de Bergerac, type locality) and Puy-de-Dome, east to Dép. Haute-Alpes and southward; Alpine and neighboring regions of Italy and the Tyrol to Croatia, Dalmatia, Montenegro and Rumelia; sporadically in the Morea; northward in southeastern Bavaria around Reichenhall and Schellenberg. In damp places under stones and dead leaves; found only in mountainous country, often abundant.

Pupa pagodula DESMOULINS, Actes Soc. Linnéenne de Bordeaux, iv, 1830, p. 161, figs. 1-3 of unnumbered plate.—ROSSMAESSLER, Iconogr., v, p. 15, f. 325.—KUESTER, Syst. Conch. Cab., p. 21, pl. 3, f. 8, 9; 9ter Ber. naturf. Ges. Bamberg, 1870, p. 100 (Triest, Croatia, Lacroma, region of Ragusa and Cattaro). — PFEIFFER, Mon. Hel. Viv., ii, 310; iii, 534; iv, 664; vi, 301; viii, 364. — MOQUIN-TANDON, Moll. France, p. 388, pl. 27, f. 35-41.—WESTERLUND, Malak. Bl., xxii, p. 129; Fauna, iii, 1887, p. 90.—PINI, Bull. Soc. Malac. Ital., ii, 1876, p. 166 (Esino region; up to 1750 meters on Mt. Codeno).—DE BETTA, Malacologia Veneta, in Atti del Regio Istituto Veneto di Sci., dett. Arti (3), 15, 1870, p. 1463 (dist. in Verona and Friuli provinces). — *Pagodina pagodula* Desm., LOCARD, Ann. Soc. Agric. Lyon (7), iii, 1896, p. 214.—CLESSIN, Molluskenfauna Oesterreich-Ungarns, 1887, p. 250, f. 150. —CAZIOT, Etude Moll. terr. fluv. Princ. Monaco et Dép. Alpes-Maritimes, 1910, p. 329, pl. 8, f. 15, 27; pl. 9, f. 46, 48 (foothills between Siagne and Var rivers, especially around Grasse; Fayence (Var) and northward to the Pic de Lachens).—HESSE, Nachrbl., 1913, p. 10 (variety, from drift of the Maritza, eastern Rumelia).

This strongly individualized Pupillid is easily known by the ascending last whorl, sinuous outer lip and toothless aperture, the last whorl belted in over the internal palatal fold. It differs from related species and races by the spaced riblets which become close on the last half-whorl, and by the single palatal fold.

Mut. *albina* Tschapeck. Three albino specimens were found with the ordinary form on outliers of the limestone mountain of Tanneben, behind Peggau, on the left bank of the Mur, 19 kilom. north of Graz, Steiermark (*Pupa pagodula* Desm. mutation *albina* Tschapeck, Nachrbl. D. M. Ges., 1885, p. 18).

1*a*. *Pagodulina pagodula austeniana* (Nevill). Pl. 20, figs. 8, 9.

This very curious form, named after my friend Colonel Godwin-Austen, was by no means rare, though evidently very local [at Mentone] in deposits *A* and *B* only. The umbilicus is broadly and widely open, but is at the same time very shallow. The two obtuse apical whorls are smooth, the next two are moderately convex, short, regular, increase rapidly in breadth, the upper one closely costulated, the ribs scarcely oblique; the lower one has these ribs more distant, less crowded and more acutely raised; the next two, of about equal height and breadth, also increase rapidly in breadth, are very convex, the ribs become still a little more acute, more oblique and less crowded; the antepenultimate has similar ribbing, is much the same in size, only a trifle more tumidly convex; it has the peculiar character that whilst on the side of the aperture it only just equals the preceding one in width, on the other side it markedly surpasses it; the last becomes abruptly much narrower above, about equal in width to the fourth whorl; on its centre it is girt with an impressed line, dividing it into two nearly equal portions, the lower of which becomes abruptly narrower and more compressed, and is brought round (or ascends) in such a manner as to peculiarly evert the aperture, and to bring the latter's outer margin right up to the suture, reminding one of the genera *Boysia, Scopelophila,* etc.; looking at it from behind the aperture, it ascends so much that at its termination it completely hides the antepenultimate whorl. The aperture is much everted, triangular, somewhat contracted by the impressed dividing groove of the last whorl. Long. 3⅙, diam. 2 mm. (*Nevill*).

Type, Indian Museum, Calcutta; also in coll. M. M. Bourguignat, Williams, Fagot, Joly and Godwin-Austen (*Nevill*).

Pupa (*Sphyradium*) *austeniana* Nevill, Proc. Zool. Soc. London, 1880, p. 130, pl. 13, fig. 9.

Though Nevill has given a lengthy account of this form, he does not mention the striation of the last half-whorl or the internal folds, nor does he point out how it differs from *P. pagodula*. Its status and relation to *P. s. adamii* remain uncertain.

1*b*. *Pagodulina pagodula sparsa* (new name). Pl. 20, figs. 5, 6, 7.

The shell is rather short with sculpture of delicate riblets more widely spaced than usual in *pagodula*, and *remaining about equally wide-spaced on the last half-whorl;* about 6 or 7 riblets may be counted in 1 millimeter on the face of the penult whorl. The palatal fold is more oblique, its inner end placed lower than in *pagodula*. The inwardly projecting tooth of the outer lip is somewhat more pronounced.

Length 3.3, diam. 1.8 mm.; 8 whorls (Rakakerwald).
Length 3.5, diam. 1.85 mm.; 8½ whorls (Marseilles).
Length 3.2, diam. 1.9 mm.; 7¾ whorls (Marseilles).

Carinthia: Rakakerwald (type loc., from Boettger coll.); Malborgeth (Westerlund, for var. *obliqua*). France: Marseilles (J. S. Phillips, in coll. A. N. S.).

Pupa pagodula var. *obliqua* Westerlund, Fauna, iii, 1887, p. 91. Not *Pupa obliqua* Nevill, 1880.

The degree of ascent of the last whorl varies rather widely among individuals of one lot. Between the spaced riblets a microscopic striation may be seen, as in typical *pagodula*.

2. Pagodulina subdola (Gredl.). Pl. 21, figs. 4 to 7.

The shell is larger, length 1⅔ lines, diam. scarcely 1 line, with nearly rounded summit; the axis straight, not bowed; the shell quite cylindric (the lowest of the 9 whorls slightly narrower); reddish brown, with a silvery sheen; tooth of the outer lip weak (*Gredler*).

The shell is cylindric, of equal diameter in the last 4 whorls. The riblets stand slightly closer than usual in *P. pagodula*, 12 in one mm. on the face of penult whorl; on the last whorl they become closer (pl. 21, fig. 6). The last whorl is flattened laterally, but not impressed as it often is in *P. pagodula*. Inside, the long upper-palatal fold is seen to be strongly developed, the lower-palatal small and short. The spiral lamella is rather low, and the strongly developed columellar lamella forms a rounded lobe.

Length 3.55, diam. 1.8 mm.; 9 whorls (Alleghe specimen).

Southern Tyrol: Fondo (Ausserer) and S. Romedio in the Nonsberge (Mognani); Salurn in the Etschtal (Gredler, type loc.); under decaying leaves in very damp places, also under small bushes and stones and on limestone cliffs. Alleghe, western part of prov. Belluno, Italy, rather common under stones around the Hotel Regina d'Italia, also at Le Grazie on the lake shore (Hesse).

Pupa pagodula var. *subdola* Gredler, Verh. zool.-bot. Ver. Wien, vi, 1856, p. 108.—*Pagodina pagodula* var. *subdola* Gredl., Clessin, Molluskenfauna Oesterreich-Ungarns, 1887, p. 250, f. 151.—Hesse, Nachrbl. D. M. Ges., 1915, p. 30.—? *Pupa pagodula* var. *adaucta* Pirona MS., de Betta, Atti del Regio Istituto Veneto di Sci., Lett., Arti (3), 15, 1870, p. 1463.

P. subdola differs from *P. pagodula* by the presence of a distinctly developed lower-palatal fold situated ventrally within the cavity of the last whorl.

Gredler doubted whether the typical form of *pagodula* occurred in the region of this form in the Tyrol, and Hesse believes it to be lacking in the Alleghe district also.

The form mentioned by de Betta as *Pupa pagodula* var. *adaucta* Pirona in litt., was defined only by the words ''whorls 9'' and the locality, ''Friuli: valle del Cornappo, with *Pupa rossmaesleri* Schm.'' It may be identical with *P. subdola* as Hesse suggested; the number of whorls agrees with that species; but without reference to types or topotypes it can hardly be identified.

The following appear to be forms or local subspecies of *P. subdola*. Their exact status remains to be fixed.

2*a*. *Pagodulina subdola* form *tschapecki* (Gredler).

''This goes into the small group of *Pupa pagodula,* and more especially in that of the larger and cylindric variety *subdola*. However, whilst this variety is more finely sculptured than the typical *pagodula, P. tschapecki* appears to have somewhat more widely spaced, though not stronger, riblets than the typical form itself. Eleven examples lie before me, so that an individual aberration is definitely excluded from consideration. Notwithstanding their size, all give the impression that the peristome (but this alone) is not fully developed'' (*Gredler*).

Gredler further gives the following as specific characters separating it from *pagodula:*

''1. *Pupa tschapecki* is larger (2 lines) than even var. *subdola,* and has a whorl more (10) than this; but it is not broader.

''2. The umbilicus is widely open (as far nearly as the third whorl from the last), round, and bordered by a rather pronounced angle of the basal whorl. In *pagodula* it is wholly closed by a sudden turning of the last whorl, even before the latter is fully formed.

''3. The aperture is almost pointed at the base, is not quadrangular as a whole, is smaller, less oblique, the peristome sharp, not expanded, not continuous. In *pagodula* as a rule it runs up to the suture or beyond it, but in *tschapecki* it runs straight forward; the impression in the middle is weaker. Yet these last peculiarities of the peristome may be consequent upon immaturity.

"4. Finally, our Pupa lacks a punctiform lamella (which authors have ignored), and which in *pagodula* is behind the columellar margin, between the lamella traversing the last whorl in the middle and the umbilical crevice" (*Gredler*).

Obersteiermark: near the railroad station Peggau, at the foot of steep limestone cliffs under stones and leaves, together with hundreds of *P. pagodula, truncatella, doliolum*, etc. (H. Tschapeck).

Pupa tschapecki Gredler, Nachrbl. D. M. Ges., viii, 1876, p. 4.

While seemingly immature, the characters other than apertural assigned may give this form standing when mature topotypes can be examined. Probably, however, it is a case of gigantism, a theory suggested by the length, the incomplete peristome, and the fact that the specimens were picked out of hundreds of "*P. pagodula*" (apparently = *subdola*).

Gredler was in error in supposing that typical *P. pagodula* has a punctiform palatal fold below the long median one, that lower fold being characteristic of *subdola* and its varieties, and wanting in *P. pagodula*.

2*b*. *Pagodulina subdola sanremoensis* n. subsp. Pl. 21, figs. 8, 9.

On a hill above San Remo on the Italian Riviera, Charles Hedley collected specimens of Pagodulina which agree with *P. subdola* by the cylindric shape, but differ by the much thickened peristome. They are like *P. subdola* and *P. s. adamii* in the presence of a short lower-palatal fold, but differ from the latter in the shape of mouth and umbilicus, as well as of the whole shell, in having no suprapalatal fold, and in the peristome, which is flesh-tinted and *very much thickened within*. This thickening extends rather far inward on the columella. The riblets are a trifle closer; on the last half-whorl they are fine and close, as usual. Length 3.5, diam. above aperture 1.85 mm.; 8½ whorls; about 12 riblets in one millimeter on the face of the penult whorl.

2c. PAGODULINA SUBDOLA ADAMII (West.) Pl. 21, figs. 1, 2, 3.

The last whorl is very closely, vertically and finely striate, the rest rather widely spaced, obliquely and strongly, fine-ribbed, the last whorl with a shallow impression in the middle, hardly as wide in front as behind. Aperture obliquely drawn out to the right, triangular, wide above, much narrower and rounded below; outer lip strongly impressed above the middle (*Westerlund*).

A topotype received from Boettger is figured. The striation, fine and close on the last half-whorl, elsewhere rather wide-spaced, does not differ materially from that of typical *pagodula*. On the face of the penult whorl there are 7 or 8 riblets in 1 millimeter. Internally there is the usual long upper-palatal fold within the ventral wall of the last whorl, but this fold differs from that of *P. pagodula* by being much higher in the middle, tapering towards both ends. Below the middle there is a *short lower-palatal fold*, and further in, above the upper-palatal, there is a delicate supra-palatal fold. All of these are visible from outside, through the shell. The spiral lamella on the parietal wall is well developed. The vertical columellar lamella forms a broad plate, tapering and turned inward at its upper end, but only very weakly notched below, where it runs out on the basal wall further than in other forms of *P. subdola*. Externally, within the umbilical cavity, there is a short, radial furrow marking the position of the base of the columellar lamella. The spiral lamella (on the upper or parietal wall within the ventral side) is long and strong, and it is accompanied by a lower, shorter lamella, further out, near the suture. These two lamellæ are immersed representatives of the parietal and the angular lamellæ of ordinary Pupillidæ. Thus there are three lamellæ and three palatal folds, or six in all, being two more than in *P. subdola*, and three more than in *P. pagodula*.

Length 3.3, diam. above aperture 1.9 mm.; 8½ whorls.

Italy: Edolo, in northeastern Lombardy (Adami).

Pupa pagodula var. *adamii* WESTERLUND, Fauna Palaärct. Reg. Binnenconch. iii, 1887, p. 91.

[*Pupa pagodula* var.] *perplicata* STERKI, Nachrbl. D. Malak. Ges. xxvi, August, 1894, p. 134.

This subspecies differs from *P. subdola* by its somewhat more swollen, less strictly cylindric shape, the last whorl being more compressed laterally over the palatal folds, and tapering towards the base; by the shape of the columellar lamella, which extends further out on the basal wall of the last whorl, its position being indicated externally by a radial furrow in the unbilical region; also by the possession of six internal laminæ, the upper two (the suprapalatal fold and the outer or " angular " lamella on the parietal wall) being additional to the four laminæ possessed by *P. subdola* and *P. s. sanremoensis*.

Perhaps this form deserves the rank of a species, but as yet no long series has been examined to test the constancy of its special characters. It appears to be a sub-Alpine form, extending from northeastern Lombardy to the Département Var, in France, whence it has been described by Dr. Sterki as *P. pagodula* var. *perplicata*. It is unfortunate that this name is later than that of Westerlund, for Sterki was the first and only author hitherto who observed the peculiar internal features of the race.

While I suspect that the forms described as *austeniana* Nevill, 1880, *adamii* Westerlund, 1887, and *perplicata* Sterki, 1894, belong to one and the same race, the final nomenclature can not be settled until the interior of *P. austeniana* is investigated.

The type lot (six specimens) of *perplicata*, with the original label, "Fayence, Var, T. Berlier, 1899" is before me through the courtesy of Dr. V. Sterki. The locality " Payence " given in his original paper, was evidently a typographic error or a misreading of the label. These specimens are now in the Sterki collection of Pupillidæ in the Carnegie Museum and in coll. A. N. S. P. The sutural fold mentioned in the original description is so slight that while it is faintly discernible externally by transparence, in a suitable light, I could not see it inside, in the shells opened.

Sterki's description of *perplicata* follows, with figures from the type and paratypes, Plate 28, figs. 11 to 14.

"The shell is of the usual size, the rib-striation moderately close above, much closer in the last half-whorl. Corresponding to the long palatal fold there is a moderately deep impression, and again one at the outer lip. Below the inner end of the large palatal fold, which is very high and strong, that is, between this palatal and the base, and opposite the strong columellar lamella, there is a shorter but rather strong fold, and a third fold above it somewhat deeper in the shell. High above, near the suture, there is a very small but distinct sutural fold. Besides these there are two lamellæ deep within on the parietal wall: one rather well developed in the middle, slowly increasing and diminishing, and another narrow and low, near the suture, both about ⅓ of a whorl long, their inner ends over the aperture. The palatal folds are visible through the shell from the outside, but the shell must be opened to learn their form and size, as well as to see the parietals and the columellar fold.

"In specimens [of *Pagodulina*] from various places in the Austrian Alps no trace of the above-mentioned lamellæ and folds were to be seen, either through the shell or in opened shells. It must be mentioned that in our species the columellar lamella is spiral at first and then turns towards the base, upon which, if strongly developed, it rests broadly" (*Sterki*). [27th line, page 176, for 1899 read 1889.]

2*d*. PAGODULINA SUBDOLA GRACILIS (Boettger). Pl. 20, figs. 13, 14, 15.

The shell is deeply rimate, cylindric, with obtuse, convexly-conic summit, narrower than *P. pagodula;* wood-brown or very pale brownish gray, the apex pale. Sculpture of very close, irregular, microscopic pitting on the first 1½ whorls, then well spaced, delicate, retractive riblets, about 7 or 8 in one millimeter on the penult whorl, about 10 in one mm. on the face of the last whorl; on the last half-whorl the riblets become vertical, and remain about as widely spaced as on the front of the whorl. The whorls are moderately convex, the last one ascending to about the middle of the penult, but much less than in *P. pagodula.* The aperture is vertical, trapezoidal with rounded base; peristome continuous, narrowly reflected, thickened within, flesh-tinted. Within the first half of the last whorl there is the usual long upper-palatal fold, a short lower-palatal below it; spiral and columellar lamellæ as in *P. pagodula;* and there is a strong callus on the columella in the throat. Length 3.5, diam. above aperture 1.6 mm.; nearly 8 whorls.

"Slender, 3⅓–3⅔ : 1½–1¾ mm. Cattaro, Messenien" (*Westerlund*).

Dalmatia: Pridworja (Bttg. coll., type loc.); oak groves at Spizza-Sutomore (J. Stussiner).

Pupa (*Pagodina*) *pagodula* Desm. var. *gracilis* BOETTGER, Nachrbl. D. M. Ges., xiv, 1882, p. 180 (no description).—*Pupa pagodula* forma *gracilis* Bttg., WESTERLUND, Fauna, iii, 1887, p. 91.

The narrower shape, the less ascending last whorl, deviating much less also in the umbilical region, and the *widely-spaced riblets of the last half-whorl,* all separate *P. s. gracilis* from *P. pagodula* and *P. subdola.* It resembles the latter in possessing a well-developed lower-palatal fold.

I have not found Dr. Boettger's description of this form. In the place cited above he mentions that "*pagodula,* typical, transitions to var. *gracilis* and var. *gracilis* Bttg." were obtained by sieving at Spizza-Sutomore in southern Dalmatia. Were it not for the transitions he alleges, I would think this a distinct species. These transitions should be investigated further.

3. PAGODULINA LEDERI (Bttg.). Pl. 20, figs. 11, 12.

Differs from typical pagodula by the more conic-ovate spire, the less convex whorls, which are *densely and acutely* rib-striate, the last one less distinctly impressed longitudinally, ascending more. The aperture is less oblique, obliquely truncate above; [peristome] less impressed below the sinulus and scarcely tuberculate there. Alt. 3.5, diam. 2 mm (*Boettger*).

Internally there is a well-developed columellar plate, a moderately long palatal fold and a weak spiral lamella (on the upper wall), in the same positions as in *P. pagodula;* there is no lower palatal fold. Externally the last whorl is not impressed though slightly flattened over the palatal fold. On the face of the penult whorl there are about 15 striæ in 1 mm. Length 3.7, diam. above aperture 1.9 mm.; 8½ whorls.

Caucasus region: woods near Lenkoran, abundant; a few in the drift débris of the Lenkoranka (Leder).

Pagodina pagodula (Desm.) var. *lederi* BOETTGER, in Radde's Die Fauna und Flora des südwestlichen Caspi-Gebietes, 1886, p. 305, pl. 3, f. 8*a-d*; also in Jahrb. D. M. Ges., xiii, 1886, p. 253, pl. 8, f. 8*a-d*.

In the absence of evidence of intergradation with *P. pagodula,* this seems specifically distinct. Figured from a Lenkoran specimen from the Boettger collection.

4. PAGODULINA (?) BOURGUIGNATI (Cout.).

Shell minute, umbilicate, globose-cylindric, very elegantly obliquely lamellicostate. Spire very obtuse, the apex smooth. Whorls 5, strongly convex, separated by a deep suture, the earlier ones increasing rapidly, the last two nearly equal, but the last a little smaller and ascending to the aperture. Aperture subrotund, with sinuous outer margin and having folds as follows: a very deeply remote palatal fold, not visible; a strong translucent spiral-lamella, reaching nearly to the aperture. Peristome a little expanded throughout, the margins strongly converging. Height 1.4, diam. 0.95 mm. (*Coutagne*).

France, Dép. Bouches-du-Rhone: Le vallon de Rognac, in drift débris.

Pagodina bourguignati COUTAGNE, Notes sur la Faune Malacologique du Bassin du Rhone, in Ann. Soc. Linnéenne de Lyon, xxviii, 1882, pp. 22, 39.

This form appears to be distinct by its few whorls, the very small size and the long parietal lamella, reaching nearly to the aperture. It seems strange that a form found in a Département so well known has not occurred to other collectors. The small number of whorls as well as the minute size suggest that this may be a Vertigine snail. It cannot be a young *P. pagodula* as Westerlund thought.

Genus SPELÆODISCUS Brusina.

Spelæodiscus BRUSINA, Mittheil. des naturwissenschaftlichen Vereines für Steiermark, Jahrg. 1885 (1886), p. 37, monotypic, for *S. hauffeni.*
Aspasita WESTERLUND, Fauna Palaärct. Reg. Binnenconch., i, 1889, pp. 18, 26; monotypic, for "sp. 75" = *H. triaria.*
Helix, Gonostoma and *Trigonostoma* of various authors.

The shell is openly umbilicate, depressed, being helicoid, much wider than high, of 4½–6½ convex, closely coiled, ribbed whorls. The aperture is strongly oblique, triangular or trilobed; the peristome is narrowly reflected or expanded except at the sinulus, below which the outer lip is calloused, toothed or bent in. Teeth are sometimes present also on the basal and parietal margins.

Type *A. hauffeni.* Distribution, Carpathian mountain system in Transylvania and the Banat, northward to the High Tatra, southwest to Albania.

This group of little Heliciform snails has been associated with the Helicodontas until recently. Rossmaessler was struck by the resemblance of *H. triaria* to *Pagodulina pagodula* in texture, sculpture and shape of mouth, but P. Hesse was the first to show that one of them, *S. triaria,* has Pupillid reproductive organs. He states that the penis has an appendix with long flagellum and a bifid penial retractor, one branch inserted on the appendix, the other on the penis (Nachrbl. D. M. Ges., no. 47, 1915, p. 58).

Clessin and others have questioned the specific distinctness of the several Transsylvanian forms of this genus, but Kimakowicz, who handled more of these shells than any other author, states that the species show no intergradation. They appear to me quite distinct with the exception of var. *tatrica* Hazay, which I have not seen, and which has not been discriminated from *A. triadis* Kim. All of the species vary rather widely in the height of the spire.

Kimakowicz states that though the ranges of *A. trinodis* and *A. triadis* partly overlap, not more than one species of the genus has ever been found in one place.

Sturany and Wagner have shown that *Helix hauffeni*

Schm., which had generally been referred to *Patula*, has the essential shell characters of the *triaria* group, and they have described a species of intermediate characters under the name *albanica*. *H. hauffeni* is a cave animal, without pigmented eyes, of very pale tint throughout, and with the peristome simplified. If these authors are right in placing *hauffeni* in the same genus as *triaria*, then the generic name *Spelæodiscus* Brusina, based upon it, will take precedence over *Aspasita* Westerlund, being at least three years earlier.

Key to Species of Spelæodiscus.

1. Aperture with a stout, obliquely entering parietal lamella and a heavy parietal callus; outer and basal margins of lip toothed. *S. trinodis*, no. 1.
   Without a parietal lamella; parietal callus thin (2).

2. 5½ to 6½ whorls; species of the Banat and Transsylvania (3).
   4½ to 5 whorls; species of Carinthia and Albania (4).

3. A conspicuous tooth within the outer lip, the peristome below it strongly thickened within. Banat. *S. triarius*, no. 2.
   Outer lip somewhat bent in but not toothed; peristome thickened but little. Transsylvania. *S. triadis*, no. 3.

4. Aperture somewhat trilobed; ribs strong; last whorl not descending in front; 4½ whorls. Albania. *S. albanicus*, no. 4.
   Aperture lunate; ribs rather close and delicate; last whorl slowly descending in front; 5 whorls. Caverns in Carinthia. *S. hauffeni*, no. 5.

1. SPELÆODISCUS TRINODIS (Kim.). Pl. 22, figs. 6, 7, 8.

The shell is perspectively umbilicate, rather depressed, solid, light to dark brown, lamellose-ribbed, silky. Whorls 6, closely coiled, the earlier increasing regularly, the last larger. Aperture triangular, 3-toothed, with reddish or brown lip, the margins drawn out, approaching. Peristome strongly repressed, reflected from the columellar angle to the tooth in the outer margin. Diam. 4.3, alt. 3.8 mm.; alt. and width of aperture 1.8 mm. (*Kim.*).

Differs from the typical *triaria* by the conspicuous thick parietal tooth, the far narrower umbilicus etc. (*Kim.*).

Height 2.9, diam. 4.5 mm.; 6 whorls.

Height 2.2, diam. 3.8 mm.; 5½ whorls.

Transylvania: Piatra Alba, Cimpu-Sirului, Grosser Skok, southern spur of the Plesa, Cimpu-Mielului and Dilma Mare in the Schiel Mts.; Skerisora at the ice cave, Unter-Girda, Toroczkoer Steinschlucht, Toroczko-Ujfalu and Tordaer Felsspalte in the Transylvanian Erzgebirge (Kim.).

Anchistoma (*Gonostoma*) *trinodis* Kimakowicz, Verh. u. Mittheil. siebenbürgischen Vereins f. Naturwiss. in Hermannstadt, xxxiv, 1884, p. 107. — *Gonostoma* (*Aspasita*) *trinodis* Kim., Verh. etc., xl, 1890, p. 45.—[*Helix triaria*] var. *transsylvanica* Hazay, Jahrb. D. Malak. Ges., xii, 1885, p. 27 (Gebirge Dilma Mare).

The stout parietal lamella is strongly connected with the columellar insertion. The tooth of the basal lip is sometimes low and spreading. Between the two lip teeth and connecting them there is a semicircular inward callus. The degree of depression of the spire is quite variable individually.

2. Spelæodiscus triarius (Rossm.). Pl. 22, figs. 1, 2, 3.

The shell is perspectively umbilicate, small, depressed, with flatly roof-like spire of 6 closely coiled whorls separated by a deep suture; horn-brown, lusterless, finely ribbed; the last whorl angular above, impressed below. Aperture lobed, very oblique; peristome reflected, with a thin dirty thickening; the outer margin impressed, with a pronounced tooth within; columellar margin with a hardly noticeable little hump (*Rossmaessler*).

Height 2.5, diam. 3.6 mm.; 5¾ whorls.

Height 2.9, diam. 4.6 mm.; 6¼ whorls.

In the Banat (Rossm.). Mehadia in the Csernatal (with the mutation *albina*), on the Domoglet, Steierdorf in the Anina gorge and at the Panur cave (Jetschin in Kimakowicz).

Helix triaria Frivaldsky, ROSSMAESSLER, Iconographie, ii, 1839, p. 13, pl. 47, f. 611. — *Gonostoma* (*Aspasita*) *triaria* Rossm., KIMAKOWICZ, Verh. etc., xl, 1890, p. 46.—*Helix ocskayi* Stentz *in sched.* according to PFEIFFER, Monographia Hel. Viv., i, 1848, p. 411 (in synonymy of *H. triaria*).—*Aspasita triaria* HESSE, Nachrbl., 1915, p. 58 (anatomy).

The size of the shell and degree of elevation of the spire vary widely in the same lot. The sculpture appears to vary locally; those from Mehadia, figs. 1, 2 (which may be taken as type locality) and from the adjacent Herkulesbad have widely-spaced riblets, while in another lot without definite locality they are more delicate and closer, fig. 3.

The invariably strong tooth within the outer lip distinguishes this from *A. triadis.* The callous thickening of the lip is usually rather heavy, in adult shells distinctly thicker than in *triadis.*

2*a*. *S. triarius tatricus* (Hazay).

Differs from both of the preceding forms [*triaria* and *trinodis*] by the thin whitish peristome almost without a lip-callus, and by having only a denticle at the place where the outer lip is impressed, the second tooth being absent or appearing hardly indicated (*Hazay*).

Northern Carpathians in the High Tatra: Belaer Kalkalpen und zwar in der Talschlucht Aufgang zum eisernen Tor und unter dem Drechslerhaeuschen (Jos. Ullepitsch, J. Hazay).

Helix triaria var. *tatrica* HAZAY, Jahrb. D. M. Ges., xii, 1885, pp. 26, 27.

I have not seen this form, and it has not been figured. As described by Hazay, its characters are those of *A. triadis;* yet as the localities are somewhat remote, a union of the two without actual comparison might be premature.

3. SPELÆODISCUS TRIADIS (Kim.). Pl. 22, figs. 4, 5.

The shell is perspectively umbilicate, small, subglobose, lamellicostate, brown, silky. The 6 convex whorls increase regularly and are separated by a deep suture, the last one not wider than the penult. The aperture is inversely ovate, lunate, toothless, not lipped. Peristome slightly reflected and a little expanded from the columellar margin to the impression of the outer margin. Diam. maj. 3.9, min. 3.7, alt. 2.6 mm.; aperture alt. 2, width 1.6 mm. (*Kim.*).

Height 2.1, diam. 3.4 mm.; 5½ whorls. Ponor Ohaba, fig. 4.
Height 2.3, diam. 3.6 mm.; 5½ whorls. Petrozeny, fig. 5.

Transylvania: Lotriora-Tal in the Cibins Mts.; Piatra Zenoga and Balea-Tal in the Schiel Mts.; Dealu Babi, Csetate Jidovilor, Piatra Rosia, Csetate Boli, Piatra Sipotului, Piatra Barului and Ponor Ohaba (type loc.; here with mut. *albina*), in the Strell Mts.; Zalasder-Tal and Schlossberg Vajda-Hunyad in the Hatszeger Mts.; Bergwerksort Boiza and Bad Gyogy in the Transylvanian Erzgebirge (Kim.).

Anchistoma (*Gonostoma*) *triadis* KIMAKOWICZ, Verh. etc., 1884, p. 107.—*Gonostoma* (*Aspasita*) *triadis* KIM., Verh. etc., xl, 1890, p. 46.

Though the outer lip is bent in, it is not toothed as in *A. triaria*, and the lip below it is thinner.

4. SPELÆODISCUS ALBANICUS (A. J. Wagner). Pl. 22, figs. 12, 13, 14.

The shell is very similar to *A. hauffeni* (F. Schmidt), but is thicker in profile, more strongly flattened laterally. The 4½ whorls increase somewhat more rapidly, and the last does not descend in front. The umbilicus is wider, the ribs substantially solider. The oblique mouth is distinctly trilobed; the peristome has a broad callus in the basal margin, a weaker, tooth-like one in the outer margin. Alt. 2.2, greater diam. 3.6, lesser 3 mm. (*Sturany & Wagner*).

Northern Albania: in drift débris of the Kiribruecke close to Mesi near Skutari, and bank of the Drinasa near Skutari (Sturany, 1905).

Aspasita albanica A. J. Wagner, STURANY and WAGNER, Denkschr., Bd. 91, 1914, p. 67, pl. 2, f. 10*a-c*.

This species is closely related to *A. hauffeni* of Carinthia but also to *A. triaria* from the Banat. "From *A. hauffeni* this species is distinguished by the more solid riblets, the last whorl not descending in front, the shape of the aperture and the toothed peristome. *Aspasita triaria* and its local forms are larger throughout, have 6 more slowly increasing whorls, a narrower umbilicus, more widely spaced ribs, the last whorl descends strongly in front, the aperture is more oblique with more distinctly thickened and diversely toothed lip'' (*S. & W.*).

5. SPELÆODISCUS HAUFFENI (F. Schmidt). Pl. 22, figs. 9, 10, 11.

Shell perspectively umbilicate, depressed, buff-white, elegantly costulate; aperture a little sinuous, very oblique, peristome acutely subreflexed, lipped with white. Alt. ¾, diam. 1½–1¾ lines; 5 whorls (*Schmidt*).

The shell is thick disk-shaped, with flatly conic spire, wart-like projecting apex and broad, perspective umbilicus; yellowish-white, somewhat opaque, but translucent and rather strong-shelled. The sculpture consists of rather close, lamelliform raised regular riblets, the embryonic whorls being smooth. Spire consists of 4½ slowly increasing, convex whorls, which are parted by a rather deep suture, the last whorl descends forward slowly but pretty deeply, and is somewhat flattened laterally. The oblique aperture is rather rounded triangular. The weakly thickened peristome expands narrowly, its insertions remote and connected by a thin callus. The insertion of the upper margin is distinctly retracted; the basal margin somewhat curved forward in the middle, the columellar margin narrowly reflected. Alt. 2.1, diam. 3.7 mm. (*Sturany & Wagner*).

Carinthia: the caves of Duplice, Jelince near St. Katharina, Mal bukuje near Dobrova, Obergurk, Podpec and Krimberg (Schmidt).

Helix hauffeni F. SCHMIDT, Verhandl. zool.-bot. Vereins, Wien, v, 1855, p. 3.—TRYON, Man. Conch. (2), iii, p. 30, pl. 22, f. 15, 16 (copied from Journ. de Conchyl., xi, 1863, pl. 13, f. 4).—*Aspasita hauffeni* F. Schm., STURANY & WAGNER, Denkschr. math.-naturwiss. Klasse der Kaiserlichen Akademie der Wissenschaften, Wien, Bd. 91, 1914, p. 67, pl. 2, f. 11*a-c*.

Schmidt noted that ''the animal is white, nearly transparent, and like the other land snails has 4 tentacles; but on the longer pair I could find no eye-spots, though I observed the animal with great care both in the grotto and after I had taken it home.''

Full-grown specimens of this species showing the weakly but distinctly lipped and narrowly expanded peristome are found in few collections; only so is it explicable that the species has been ranked sometimes in *Punctum,* sometimes in *Patula.* With these characters of the shell in view we find a great agreement with the forms of the group *Aspasita* Wstld., which has been recognized to be a Pupid (*Sturany and Wagner*).

Subfamily Acanthinulinæ.

This group of three or four genera is now believed by some malacologists to be closely related to *Vallonia.*

Genus SPERMODEA West.

Spermodea WESTERLUND, Methodus dispos. Conch. extramar. Reg. Palæarctica viv., in Rada Jugoslav. Akad. Znanosti i Umjetnosti, vol. 151, 1902, p. 90, type *Hx. lamellata* Jeffr.
Helix and *Acanthinula* of authors.

The shell is umbilicate, heliciform, slightly wider than high, with dome-shaped spire of closely coiled, narrow whorls, the initial 1½ microscopically, irregularly pitted, the rest axially costulate. Aperture subvertical, lunate, with simple sharp lip, the columellar margin dilated, insertions remote.

Type: *Helix lamellata* Jeffr. Distribution: Europe.

By characters of the shell this group appears to differ sufficiently from *Acanthinula* for generic distinction. The single Tertiary species known, *S. plicatella* is extremely similar to the existing *S. lamellata,* and is regarded by Wenz as probably ancestral to that.

SPERMODEA PLICATELLA (Reuss). *Helix plicatella* Reuss, Palæontographica, ii. 1849, p. 11, 21, pl. 1, f. 10.—*Acanthinula plicatella* Wenz, Foss. Cat., p. 975.—*Helix corculum* A. Braun, Amtl. Bericht über d. 20. Versamml. Ges. D. Naturf. u. Aerzte zu Mainz, 1842, p. 148 (nude name).—*Helix corcu-*

lum R. Braun, in Walchner, Handbuch d. Geognosie, 2d ed., 1851, p. 1139 (nude name).—*Helix plicatella corniculum* Ludwig, Geognosie u. Geogenie der Wetterau, Festschr. Wetterau. Ges. f. d. ges. Naturk. zu Hanau., 50 Jahr., 1858, p. 118. Upper Oligocene, Chattien: Hochheim-Flörsheim, to Lower Miocene, Burdigalien: Bohemia.

1. Spermodea lamellata (Jeffreys). Pl. 32, figs. 1, 2, 3.

The shell is narrowly umbilicate, dome-shaped, thin, chamois-colored, with a silky luster; compactly coiled, composed of about 5½ strongly convex, slowly increasing whorls, the penult widest, viewed from above, the last rounded peripherally and at base, impressed around the circular, deep umbilicus. Sculpture of narrow, subvertical, cuticular riblets, with (about 5) microscopic striæ in each interval; the initial 1½ whorls microscopically, densely pitted. The aperture is nearly vertical, lunate; lip thin and sharp, the columellar margin dilated; lip insertions remote, a smooth area, spreading forward, between them.

Height 1.9, diam. 2.2 mm.

Great Britain and Ireland; Sweden; Denmark and the Baltic coast of Germany; diluvial deposit near Illertissen, south of Ulm a. D., southern Germany. Type loc.: Scarborough, York. Usually found among dead holly or beech leaves.

Helix lamellata Jeffreys, Trans. Linn. Soc. Lond., xvi, 1830, p. 333; Brit. Conch., i, p. 175; iv, p. 158.—Westerlund, Fauna, i, 1889, p. 17.—Rimmer, Quart. Journ. of Conch., i, 1877, p. 265 (description of living animal).—*Acanthinula lamellata* Boycott, Journ. of Conch., xv, April, 1917, p. 175, figs. (genitalia).—Steenberg, Vid. Meddel. Dansk. naturh. Foren. Kjobenhavn, vol. 69, 1918, p. 6, f. 3 (genitalia).—*H. Watson*, Proc. Malac. Soc. London, xiv, p. 17.—Geyer, Nachrbl., 1915, p. 67 (occurrence in southern Germany).

Helix scarburgensis Turton, Manual Land and Fresh-water Shells Brit. Is., 1831, p. 62, fig. 48 (Scarborough).—Rossmaessler, Iconogr., ii, pt. 8, p. 37, no. 533.—*Helix seminulum* Rossmaessler, t. c., on pl. 39, f. 533 (Kiel).

[*Helix*] *holosericea* Miller Ms. acc. to Jeffreys, *l. c.*, 1830.

Acanthinula lamellata var. *albina* Schlesch, The Naturalist, Feb. 1921, p. 82. — *Cf.* Sundler, Journ. of Conch., xvii, p. 155!—*Acanthinula lamellata* var. *albida* Berthold Sundler, Journ. of Conch., xvi, 1922, p. 285. — R. A. Phillips, Journ. of Conch., xvii, 1923, p. 34 (Maryborough, Queens Co., Ireland).

A very distinct species by the closely coiled whorls of its dome-shaped spire and the beautiful sculpture.

Mut. *albina* Schlesch is a white form of *A. lamellata*, found in a range of hills west of Boras, Sweden, with the usual form. Also taken in Ireland.

2. Spermodea spermatia (Castro).

Shell minute, globulose, perforate, very strongly convex above, rounded, convex beneath; rather pellucid, glossy, corneous-amber colored, under a lens very elegantly lamellicostate. Spire roundly elevated, very obtuse, the apex smooth. Whorls 5½, slightly convex, very slowly and regularly increasing, separated by an impressed suture, the last whorl scarcely wider above, slightly convex, not descending in front, rounded below. Aperture nearly vertical, very narrow, strongly lunate, rounded; peristome simple, unexpanded, acute, the margins widely remote. Height 1½, diam. 2 mm. (*Castro*).

Portugal: wood of Bussaco.

Helix spermatia J. da Silva e Castro, Journal de Sci. Math. Phys. e Nat. Acad. Real Sci. Lisboa, xi, 1887, p. 249.

This form has not been distinguished satisfactorily from *S. lamellata*. It has not been figured.

Genus ACANTHINULA Beck.

Acanthinula Beck, Amtl. Ber. Ver. Kiel, 1846, p. 122.—Pilsbry, Manual, ix, p. 280.—Wiegmann, Nachrbl. D. M. Ges., 1896, p. 129, and in Hesse, Nachrbl., 1915, p. 56, f. 1-3 (anatomy and systematic position).—Steenberg, Videnskab. Meddel. Dansk naturkist. Foren. Kjobenhavn, vol. 69, 1918, p. 1-9 (anatomy).—Watson, Proc. Malac. Soc. Lond., xiv, 1920, pp. 6-30 (anatomy, systematic position).

Euacanthinula Westerlund, Fauna, i, 1889, p. 16. *A. aculeata* here designated type.

Aulaca Westerlund, Rada Jugoslav. Akad., cli, 1902, p. 89. *A. aculeata* here designated type.

Shell turbinate, perforate or umbilicate, of few rapidly increasing, rounded or subangular whorls. Initial 1½ whorls spirally striate, the rest with oblique riblets, much narrower than the intervals, largely cuticular, each bearing a filament or spine forming a crown above the periphery (sometimes wanting in the adult stage, and of course lacking in fossils). Aperture oblique, rounded-lunate, the lip with remote insertions, thin, or thickened within and with a membranous expansion; columellar margin dilated.

Type: *A. aculeata* (Müller). Distribution: western Palæarctic and eastern Ethiopian Regions.

Palæontology.—*Acanthinula* appeared near the base of the Palæocene in forms somewhat intermediate in shape between that genus and *Zoögenetes.* It was most abundant in species in the Oligocene and Miocene, several of them resembling the Canarian *A. spinifera* (Mouss.)). *A. nana,* with the sculpture of *Acanthinula,* is in shape and size more like *Punctum;* it appears to have left no descendants. *A. tuchoricensis,* the only Tertiary species I have seen, has the embryonic whorls spirally sculptured like the genotype, *A. aculeata.* Other Tertiary species do not appear to have been specially examined for this character.

The following list of Tertiary species is compiled from Wenz, Fossilium Catalogus, 1, Animalia, Part 20, iii (1923).

Acanthinula archiaci (Boissy). *Pupa archiaci* Boissy, Mém. Soc. Géol. France (2), iii, 1848, p. 275, pl. 5, f. 21.—*? Acanthinula archiaci* Wenz, Foss. Catal., iii, p. 969. Lower Paleocene, Thanétien: Rilly-la-Montague near Reims.

Acanthinula armoricensis (Cossmann). *Helix stueri* Cossm., Bull. Soc. nat. Ouest France, v, 1895, p. 172, pl. 5, f. 16, 17 (not of Cossmann 1892).—*Helix armoricensis* (Oppenheim) Cossm., Bull. Soc. Sc. Nat. Ouest France (2), ii, 1902, p. 115, pl. 11, f. 2.—*Acanthinula a.,* Wenz, Foss. Cat., iii, p.

969. Lower Eocene, Lutétien; Calcaise grossier, Boisgouet (Loire Inf.).

Acanthinula cenchridium (Cossmann). *Helix cenchridium* Cossm., Bull. Soc. Sci. Nat. Ouest France (2), ii, 1902, p. 116, pl. 11, f. 3, 4.—*Acanthinula c.*, Wenz., Foss. Cat., p. 970. Lower Eocene, Lutétien: Bois-Gouet (Loire-Inf.).

Acanthinula dumasi (Boissy). *Helix dumasi* Boissy, Mém. Soc. Géol. France (2), iii, 1, 1848, p. 273, pl. 5, f. 13.—*Helix geslini* Boissy, t. c., p. 273, pl. 5, f. 14.—*Acanthinula dumasi* (Boissy), Wenz, Foss. Cat., p. 970. Lower Paleocene, Thanétien: Rilly-la-Montagne near Reims; Cheney (Dép. Marne).

Acanthinula hesslerana Joos. Centralbl. f. Min., Geol. u. Pal., 1911, p. 705; Jahrb. Nassau. Ver. Naturk., Wiesbaden, vol. 64, 1911, p. 66, text fig. 3.—*A. hessleriana* Wenz, Foss. Cat., p. 971. Lower Oligocene, Sannoisien: Strophostomakalk, Eselsberg bei Ulm, a. D.

Acanthinula (?) imperforata (K. Miller). *Hyalinia (Conulus) imperforata* K. Miller, Jahresh. Ver. vaterl. Naturk. Württemb., vol. 63, 1907, p. 442, pl. 7, f. 11.—*?? Acanthinula i.*, Wenz, Foss. Cat., p. 971. Strophostomakalk, Eselsberg bei Ulm, a. D.

Acanthinula nana (A. Braun). *Helix nana* A. Braun, in Walchner, Handbuch der Geognosie, 2d edit., 1851, p. 1140.—Sandberger, Vorwelt, p. 324, pl. 22, f. 14.—*Acanthinula nana* Wenz, Foss. Cat., p. 972.—*Helix (Hyalina) euristhmia* Slavik, Archiv d. Naturw. Landesdurchforschung von Böhmen, 1, 1869, p. 236, pl. 4, f. 5, 6. Upper Oligocene (Chattien) to Upper Miocene (Tortonien), Germany, Bohemia.

Acanthinula paludinæformis (Sandberger). *Helix p.*, Sandb., Conchyl. Mainzer Tertiärbeckens, 1858, p. 17, pl. 3, f. 9.—*Acanthinula p.*, Wenz, Foss. Cat., p. 973. Middle Oligocene, Repulien: Elsheim, Rheinhessen; Upper Oligo., Chattien: Hochheim-Flörsheim, Hessen-Nassau.

Acanthinula paronæ (Sacco). *Helix (Acanthinula) paronæ* Sacco, Bull. Soc. Malac. Ital., xii (1887), p. 185; I Moll. ter. Terz. Piemonte, xxii, p. 68, pl. 5, f. 29. Upper Pliocene, Astien: Villafranchian of Tarsarolo, Prov. Alessandria, Italy.

Acanthinula stampinensis (Desh.). *Helix stampinensis* Deshayes, Descr. Anim. s. Vert. Bassin Paris, ii, 1863, p. 825, pl. 52, f. 16-18. — *Acanthinula s.,* Wenz, Foss. Cat., p. 976. Upper Oligocene, Chattien: Côte-St.-Martin near Etampes (Seine-et-Oise).

Acanthinula stueri (Cossm.). *Helix stueri* Cossmann, Cat. Ill. Coq. Foss. Eoc. env. Paris, v, 1892, p. 79.—*Acanthinula s.,* Wenz, Foss. Cat., p. 977. *Helix (Acanthinula) bouryi* Cossm., 1889, not of de Morgan, 1885. Lower Eocene, Lutétien: Calcaire grossier, Neauphlette (Seine-et-Oise); Trye (Oise); Middle Eocene, Bartonien: Le Guépelle (Seine-et-Oise).

Acanthinula trochulus (Sandberger). *Pupa (Modicella) trochulus* Sandb., Land- und Süsswasserconch. Vorwelt., 1874, p. 601, pl. 29, f. 25.—*Acanthinula t.,* Wenz, Foss. Cat., p. 977. Upper Miocene: Württemberg, Austria, Hungary.

Acanthinula tuchoricensis (Klika). *Helix (Acanthinula) t.,* Klika, Archiv naturw. Landesdurchforschung Böhmen, vii, 1891, p. 42, f. 35.—*Acanthinula t.,* Wenz, Foss. Cat., p. 978.—Lower Miocene, Burdigalien: Landschneckenkalk, Lipen and Tuchorshitz, Bohemia; Upper Miocene, Tortonien: Oppeln, Silesia.

Acanthinula aculeata (Müller). Pl. 32, figs. 4, 5, 6.

The shell is umbilicate, broadly conic with very obtuse apex and rounded periphery and base, thin, cinnamon-colored. Whorls convex, the first 1½ with sculpture of very fine, raised spiral striæ, the rest with narrow, oblique, retractive riblets, in great part cuticular, and about 30 in number on the last whorl; above the periphery each is widened triangularly and produced in a spine, causing the last two whorls to appear shouldered. Surface between the riblets is finely, irregularly striate and with rather indistinct, impressed spiral lines. The aperture is oblique, circular except that about one-fourth of the circle is excised by the preceding whorl. Periphery having a cuticular expanded margin and thickened within by a white callous rib. Columellar margin dilated.

Length 2, diam. 2 mm.; 4 whorls (France).

Length 2, diam. 2.3 mm.; 4 whorls (France).

Length 2, diam. 1.8 mm.; 4 whorls (Germany).

Length 1.75, diam. 2 mm. (France).

Europe; Asia Minor and Transcaucasia; Algeria and Morocco. Pliocene, Montpellier; Pleistocene, England.

Helix aculeata MÜLLER, Vermium etc. Historia, ii, 1774, p. 81.—ROSSMAESSLER, Iconogr., II, viii, p. 38, pl. 39, f. 536.—PFR., Monogr., i, p. 50.—MOQUIN-TANDON, Moll. France, ii, p. 189, pl. 15, f. 5-9.—JEFFREYS, Brit. Conch., i, 1862, p. 176, with var. *albida*.—WESTERLUND, Nova Acta Soc. Sci. Upsal. (3), viii, 1873, p. 58, with var. *sublævis*.

Acanthinula aculeata KENNARD & WOODWARD, Essex Naturalist, x, 1897, p. 93 and table; Journ. of Conch., 1903, p. 354; Proc. Malac. Soc. London, viii, p. 91; Q. Journ. Geol. Soc., vol. 75, 1919, p. 229 (Pleistocene and Holocene of England). — WENZ, Fossilium Catal., Pt. 20, iii, p. 968 (Middle Pliocene, Plaisancian: Montpellier).

Helix spinulosa LIGHTFOOT, Philos. Trans. Roy. Soc. London, vol. 76, 1786, p. 166, pl. 2, f. 1-5.—MONTAGU, Test. Brit., 1803, p. 429, pl. 11, f. 10.

Helix granatelli BIVONA, Occhio, 1839, no. 9, f. 2 (teste Pfeiffer; not seen by H. P.).

Helix delectabilis Solander, according to Montagu, 1803, p. 430.

Helix nucleata Turton, according to Montagu, l. c.; apparently a typographical error for *aculeata*.

A widely-spread and variable species. According to Müller, who gave an excellent description, there should be 28 to 30 riblets on the last whorl. The specimen drawn in fig. 5 has 30. A German specimen, fig. 6, has 22. The filaments at the shoulder are extremely variable in degree of development, though rather constant, except as affected by wear, in single colonies, in the material at hand. The thickness of the lip also varies widely in different lots. I do not know that any comparative study has been made of these variations, which may be correlated with ecologic factors, or perhaps denote minor races.

Sicilian specimens seen, fig. 4, have very delicate riblets, often largely deciduous, but when best preserved they bear long filaments. The lip-rib is of the same cinnamon color as the shell. Perhaps they should be segregated as a race. Pfeiffer has mentioned a "*Helix granatelli* Bivon. fil. in Occhio, 1839, N. 9, f. 2," which I have not traced.

Jeffreys has noted a mut. *albida*, with the shell whitish.

Acanthinula aculeata sublaevis West. Shell almost without riblets, having no keel filaments, the aperture with a rose-colored lip. Sweden, Denmark, Switzerland; type loc.: Ronneby.

Boettger reports (Nbl. D. M. Ges., vol. 37, 1905, p. 103) a specimen of form *sublaevis* West. from the Sarus debris, Adana, Cilicia. It is smaller and lower than usual. Alt. 1½, diam. 1¾ mm. He regards Westerlund's variety as merely shells which have lost their cuticular ribs by wear with age. He records *A. aculeata* from Transcaucasia, Russian Armenia and the Talysch district.

ACANTHINULA SPINIFERA (Mouss.).

Vol. iii, p. 54. Palma and Grand Canary, Canary Islands.

Helix spinifera MOUSS., Révision Fauna Malac. des Canaries, p. 25, pl. 2, f. 17-20.—*Patula spinifera* Mouss., PFEIFFER, Novit. Conch., iv, 1870-76, p. 63, pl. 120, f. 17-20.

ACANTHINULA AZORICA n. sp. Pl. 32, figs. 7, 8.

The shell is narrowly umbilicate, turbinate, higher than wide, thin, cinnamon or a little darker colored, the apex whitish. Whorls convex, the first 1½ rather coarsely striate spirally, the rest with delicate, well-spaced, cuticular riblets, oblique and weakly sigmoid, their intervals having fine, weak striæ and in places showing low spiral striation. Suture deep from the beginning. Aperture rounded-lunate, the outer lip very slightly expanded, narrowly thickened within with a cinnamon callus, the columellar margin dilated.

Length 2.25, diam. 1.7 mm., 4½ whorls. Type.

Length 2.1, diam. 1.75 mm., 4¼ whorls.

Azores: S. Miguel (Morelet). Type 1515 ANSP.

Helix aculeata MORELET, Hist. Nat. des Açores, 1860, p. 175.—*Patula aculeata* WOLLASTON, Testacea Atlantica, 1878, p. 23. Not *H. aculeata* Müller.

According to Morelet and Drouet, the shell they called *H. aculeata* occurs at high elevations, in the laurel woods among fallen leaves. Morelet reported it from S. Miguel and Fayal. The specimens before me from the former island were received from Morelet as *H. aculeata.*

It differs from the continental *A. aculeata* by the more lengthened shape and the very delicate riblets without trace of appendages, though these may be present in fresh, young specimens, as Mousson found them in *A. spinifera.*

Acanthinula expatriata Preston. Pl. 32, fig. 9.

Shell globosely turbinate, with elevated spire, thin, covered with a shining pale bronze periostracum, which is raised on the later whorls into rather distant, regular, very oblique ridges, each ridge bearing a coarse, long, broad-based, membranaceous bristle at the periphery; whorls 4, rapidly increasing, convex; suture deeply impressed; base of shell convex, showing traces of very fine, spiral sculpture between the ridges of the periostracum; umbilicus narrow, very deep, partly concealed by the expansion of the outer margin of the columella; columella descending in an oblique curve and diffused above into a whitish, parietal callus, both it and the labrum white, slightly reflexed and outwardly broadly surrounded by a reflexed extension of the membranaceous periostracum, thus forming a double margin; aperture subcircular. Alt. nearly 2.5, diam. maj. 2 mm. (*Preston*).

British East Africa: Mount Kenia, at an altitude of 9,000-10,000 feet.

Acanthinula expatriata Preston, Ann. Mag. N. H. (8), vii, May, 1911, p. 469, pl. 11, f. 17.

This form appears to be very closely related to *A. aculeata.*

Acanthinula peracanthoda (Bgt.).

Vol. iii, p. 54. Abyssinia.

Species of uncertain position.

If it were not that Moellendorff was acquainted with the genus *Pupisoma* when he wrote the following descriptions, I would refer these species to that genus. Under the circumstances, as I have not seen the shells, they are left in *Acanthinula.*

ACANTHINULA PERPUSILLA Mlldff.

Shell moderately, deeply umbilicate, globosely turbinate, thin, subpellucid, most minutely striate, nearly smooth, corneous-fulvous. Spire much elevated, the sides rather convex. 4½ moderately convex whorls, subangular at the suture, the last very shortly descending in front. Aperture moderately oblique, broadly ovate, the peristome slightly expanded, columellar margin rather deeply sinuate, dilated. Diam. and height 1.5 mm. (*Mlldff.*).

Java (Fruhstorfer).

Acanthinula perpusilla MOELLENDORFF, Nachrbl. D. M. Ges., vol. 29, 1897, p. 66.

ACANTHINULA TILUANA Mlldff.

Shell narrowly umbilicate, elevated-turbinate, minutely striatulate, corneous-buff. Spire strongly raised with somewhat convex sides. Whorls 5, moderately convex, somewhat flattened in the middle, the last scarcely descending. Aperture rather oblique, oviform; the peristome very narrowly expanded, columellar margin slightly sinuate, somewhat thickened, a little dilated above. Diam. 1.33, alt. 1.5 mm. (*Mlldff.*).

Java (Fruhstorfer).

Acanthinula tiluana MOELLENDORFF, Nachrbl. D. M. Ges., vol. 29, 1897, p. 66.

Genus ZOÖGENETES Morse.

Zoögenetes and *Zoögenites* MORSE, Journ. Portland Soc. N. H., i, 1864, p. 32, for *Helix harpa* Say.
Helix and *Acanthinula* of many authors.

The shell is thin and elastic, narrowly umbilicate, ovate-conic, higher than wide, of few rapidly increasing, convex whorls, the first two smoothish, the rest having delicate, widely-spaced, oblique riblets. Aperture ovate, oblique, the lip thin and simple, dilated near the columellar insertion, margins remote.

The margins of the foot are crenulated; head with crenulated labial processes and very short inferior tentacles. Viviparous.

There is only one well-known recent species of *Zoögenetes,* the Japanese *Z. harpula* being unfigured and referred to this genus with considerable doubt.

The distribution of *Z. harpa* is remarkably discontinuous, the Swiss, Scandinavian, Transcaspian and east Siberian herds being widely separated. In America the scattered colonies south of Maine appear to be very small and isolated.

Morse spelled the name Zoögenetes on page 5 of his memoir, and in the first and second references on page 32, but then wrote the species "Zoogenites harpa." We use his first spelling, which has already been preferred by Lindholm.

Zoögenetes harpa (Say). Pl. 32, fig. 10.

The shell is narrowly umbilicate, ovate-conic, thin, somewhat transparent, olive-green, rather glossy, early whorls nearly smooth, the last two with sculpture of delicate, well-spaced cuticular riblets or laminæ in the direction of growth-lines, about 30 on the last whorl, becoming crowded toward its end. Summit obtuse. Whorls nearly 4, rounded. Aperture oblique, ovate, the lip thin and simple, dilated at the axial termination. Length 3.25, diam. 2.5 mm.

Massachusetts, Maine and Prince Edward Island west to Minnesota, Hudson Bay and Alaska; Kamchatka and the lower Amur valley; northern Scandinavia; Finland; and Peterhof in the Baltic Prov. of Russia; Horei-Vor on the Kolva River, Archangel Government; southern Switzerland; Askhabad, Transcaspia.

Helix harpa Say, App. Long's Exped., ii. 1824, p. 256, pl. 15, f. 1.—Binney and Bland, Land and Freshwater Shells N. A., i, p. 156, f. 266-269 (Gaspé; New Hampshire; English River, Manitoba; James Bay).—Westerlund, Fauna, i, 1889, p. 17; Vega Exped. Vet. Arbeten, iv, p. 149, 152, 159, 160, 162, 170, 171 (Chuckchi Peninsula; Konyam Bay, eastern Siberia; Bering Island, etc.). — Craven, Journ. de Conchyl., 1888, p. 101 (Riffelalp near Zermatt, Switzerland, 2100 meters under fallen bark of *Pinus pinca*).—Schlesch, Hull Museum Publications No. 112, 1917, p. 166, text-fig. (localities in Norway, Sweden, Finland). — *Acanthinula harpa* Say, BINNEY, Terr. Moll., v, p. 342.—Hanham, Nautilus, x, p. 99 (Quebec). —HENDERSON, Nautilus, xxvii, p. 96 (Ellsworth, Maine).—NYLANDER, Nautilus, xiii, p. 103 (Ft. Kent, Me.); xxvii, p. 141 (New Brunswick).—JACKSON, Nautilus, xxi, p. 144 (North Haven, Me.). — BERRY, Nautilus, xxiv, p. 63 (Windermere, Waldo Co., Me.).—WALKER, Ill. Cat. Moll. Michigan, i, 1906, p. 508, f. 122-125 (Upper Peninsula and Grand Traverse region). — ODHNER, Moll. d. Lappland Hochgeb., in Hamberg, Naturwiss. Unters. d. Sarekgebirges in Schwed.-Lappl., Zool., iv, p. 140.—PILSBRY, Man. Conch., ix, p. 281, pl. 70, f. 23-25. —SUNDLER, Journ. of Conch., xvi, p. 285 (hills west of Boras, Sweden, the most southern loc. in Sweden). — *Patula harpa* Say, NORMAN, Ann, Mag. N. H. (7), x, p. 475.

Zoögenites harpa MORSE, Journ. Portland Soc. N. H., i, 1864, p. 32, pl. 1, f. 1-14; Amer. Nat., i, 1868, p. 608, f. 50, 51. —DALL, Harriman Alaska Exped., xiii, Moll., pp. 12, 21 (Avacha Bay, Kamchatka; Klehini, Chilkat Inlet and valley, Alaska; English River, Manitoba; Moose Factory, Hudson Bay).—*Zoögenetes harpa* LINDHOLM, Annual of the Zool. Mus. Russian Acad. Sci., xxiii, 1922, p. 309 (distribution in Europe and Asia).

Pupa costulata MIGHELS, Proc. Boston Soc. N. H., i, 1844, p. 187 (Portland, Maine).

Helix amurensis GERSTFELDT, Land- u. Süsswasser Moll. Sibir. u. Amur, p. 13, in Mém. de l'Acad. Imp. des Sci. de St.-Pétersb., Ser. 6, ix, 1859, p. 517, pl. 9, f. 26 (whole lower Amur valley).

The embryonic whorls appear smooth, but under the microscope they show an extremely minute, dense and irregular roughness of pits and granules. On later whorls there is some irregularly developed but very low striation between and parallel to the riblets. In some fresh specimens the riblets are unequal, inconspicuous or in part obsolete.

Localities in the Academy collection, not mentioned above, follow:

Prince Edward Island (B. Long). North shore of Lake Superior. Great Slave Lake (G. H. Horn). Minnesota: Duluth (Witmer Stone). Maine: Mt. Desert (Colton); Fairfield, Somerset Co. (B. Long); Buckfield, Oxford Co. (J. A. Allen). Massachusetts: High Pines, Duxbury (W. F. Clapp); New Bedford (Thomson).

2. ZOÖGENETES(?) HARPULA (Reinh.).

Shell dextral, minute, conic, umbilicate, corneous. Four cylindric, regularly increasing whorls, under the lens delicately striate, silky, the last two-fifths of the length, rounded, not descending. Suture deep. Aperture oval, vertical; peristome unexpanded, acute, the columellar margin broadly reflected. Length 1.5, width 1.25 mm. (*Reinh.*).

Japan: Tokyo, Kanda (Dr. Gottsche).

Helix (Acanthinula) harpula REINHARDT, SB. Ges. Naturf. Freunde Berlin, 1886, p. 115.

The shell is a diminutive picture of the northern *H. harpa* Say, except that the prominent, regular epidermal ribs of the latter are wanting. Isolated ones among the striæ visible under the lens show a tendency to stand out as weak ribs, but without any regularity (*Reinh.*).

An unfigured species, which from the description appears to resemble *Pupisoma;* with that genus the type should be compared.

Genus ACANTHOPUPA Wenz.

"Shell elongate-ovate with blunt embryonic end, narrowly umbilicate; with the exception of the first, all whorls have oblique, widely-spaced, transverse ribs. Aperture with simple, sharp margins and reflected columellar margin." Type *Acanthopupa joossi* Wenz, pl. 32, figs. 19, 20.

"This genus differs primarily from *Acanthinula* by the elongate form of the shell, which is much higher than wide."

ACANTHOPUPA JOOSSI Wenz (pl. 32, figs. 19, 20), Jahrb. Nassau. Ver. Nat., 67th Jahrg., 1914, p. 103, pl. 7, f. 29. Upper Oligocene, Chattien: Landschneckenkalk, Hochheim-Flörsheim.

It is regarded by Wenz as probably of great significance in the phylogeny of *Acanthinula*, the shell-form uniting that genus to *Vertigo*. Unless much earlier Acanthopupæ are found, it appears uncertain whether the genus is ancestral to *Acanthinula* or a secondarily pupoid derivative thereof. *Acanthinula* appeared in the Palæocene, long before the advent of *Acanthopupa* as now known.

SUPPLEMENT TO VOLUMES XXIV–XXVII.

Subfamily GASTROCOPTINÆ.

GASTROCOPTA (Vol. XXIV, p. 6).

Falsopupa Germain (see Vol. XXV, p. 370) is a synonym of the typical group of *Gastrocopta*.

A new key to the North and Middle American species of the typical group of *Gastrocopta* is given below, as that in Vol. XXIV, pp. 54-57, is defective, at least one species (which was not then accessible to me) being wrongly placed; also, there are errors in the lettering of some of the entries.

Key to American Subgenera of Gastrocopta.

1. One or two teeth on the parietal wall are very small or minute (2).
   Teeth of the parietal wall are moderately to strongly developed (3).

2. Palatal folds present. Subgenus *Vertigopsis*, xxiv, 27.
   No palatal folds or palatal callus. Subgenus *Privatula*, xxiv, 52.

3. Palatal folds standing on a white callus; aperture nearly filled by the large teeth. Subgenus *Albinula*, xxiv, 13.
   Palatal folds not connected by a callus (4).

4. Angular and parietal lamella diverging forward, the whole like a mirrored letter *y*. Subgenus *Immersidens*, xxiv, 38.
   Angular and parietal lamellæ concrescent into a sinuous or bilobed lamella, or with the outer end of the parietal projecting very little or not at all from the angular. Subgenus *Gastrocopta*, proper, xxiv, 53.

Key to North and Middle American species and principal subspecies of the subgenus Gastrocopta proper.

1. Lip distinctly or heavily calloused within (2).
   Lip thin, not calloused within (16).

2. Form decidedly tapering (3).
Form cylindric or subcylindric (6).

3. Lower palatal fold long, its inner end not visible in a direct front view; Curaçao group. *G. octonaria*, p. 199.
Lower palatal shorter, wholly visible in a front view (4).

4. Corneous or whitish, the lip white. *G. rupicola*, xxiv, 58.
Cinnamon-colored, the lip tinted (5).

5. A subcolumellar nodule present. *G. r. duplex*, xxiv, 60.
No subcolumellar nodule. *G. r. marginalba*, xxiv, 60.

6. Angulo-parietal lamella strongly bifid in a front view (7).
Angulo-parietal lamella simpler, sinuous (15).

7. Small, length about 2 to 2.5 mm., diam. above aperture 1 mm. or less (8).
Larger, length 2.25 to 3, diam. 1 mm. or more (11).

8. Lower-palatal fold very long, its inner half curved, inner end not visible in a front view. Curacao group (9).
Lower-palatal fold of moderate length, straight (10).

9. A strong tubercle below the columellar lamella. *G. octonaria*, p. 199.
A tapering butress below the columellar lamella. *G. curacoana*, p. 197.

10. Lower-palatal fold not very deeply immersed. Antilles. *G. barbadensis*, xxiv, 83, 85.
Lower-palatal fold deeply immersed. Dakota to N. M. *G. r. mcclungi*, xxiv, 66.

11. Anterior end of parietal lamella distinctly projecting on the columellar side of the tooth (in an obliquely basal view) (12).
Anterior end of parietal lamella not conspicuous (13).

12. Lip-callus marginal. *G. p. mcclungi*, xxiv, 66.
Lip-callus further within. *G. p. sterkiana*, xxiv, 357.

13. Lip heavily calloused (14).
Lip-callus thin; an infraparietal tubercle often present. *G. riograndensis*, xxiv, 69.

14. A callus below the columellar lamella. *G. procera,* xxiv, 62.
No callus below columellar lamella. *G. p. riparia,* xxiv, 65.

15. A strong crest behind the lip; 2.3 to 3.2 mm. long, more than 1 mm. wide. Oklahoma to Arizona. *G. cristata,* xxiv, 68.
Length 2 to 2.2 mm., diam. 0.9 mm. Bimini Islands. *G. p. biminiensis,* xxiv, 78.

16. Having 5 or more well-developed teeth; a basal fold present (17).
Having 4 strong teeth, the anguloparietal almost simple; no basal fold; shell whitish; New Mexico and Arizona. *G. quadridens,* xxiv, 57.
Teeth small (3 to 5), a basal fold usually wanting; upper palatal fold minute when present (22).

17. Diam. above aperture usually more than 1 mm., about 2.5 mm. long; brownish (18).
Diam. 1 mm. or less; length 1.5 to 2.6 mm. (19).

18. No crest behind the lip; angulo-parietal lamella not strongly bifid; no infraparietal tubercle. *G. servilis,* xxiv, 70.
A narrow crest; angulo-parietal lamella bifid; an infraparietal tubercle often present. *G. riograndensis,* xxiv, 69.

19. Angulo-parietal lamella strongly bifid; a callus or tooth below the columellar lamella (20).
Angulo-parietal sinuous or emarginate but not distinctly bifid. *G. pellucida* and varieties, xxiv, 75.

20. Lower-palatal fold very long, its inner end not visible in a front view. *G. curacoana,* p. 197.
Lower-palatal fold not very long (21).

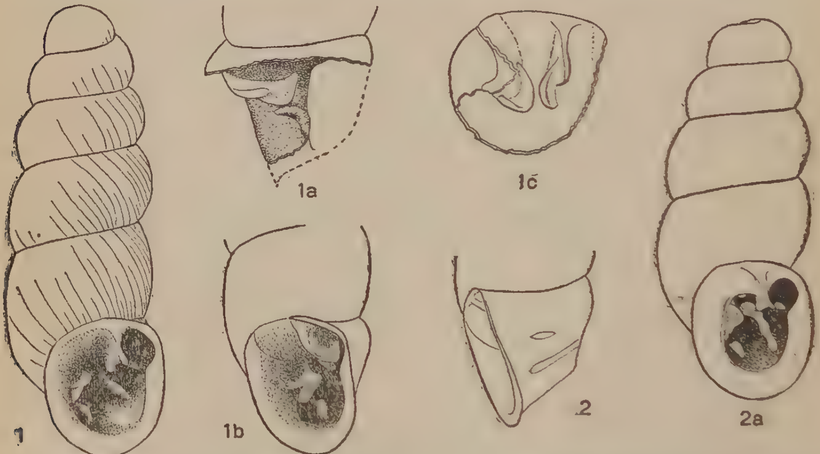
21. An infraparietal tubercle present. *G. polyptyx,* xxiv, 89.
No infraparietal tooth. *G. barbadensis,* xxiv, 83.

22. Length 2.2 to 2.4, diam. above aperture 0.95 mm. St. Thomas. *G. s. riisei,* xxiv, 74.
Slightly narrower, with deeper suture; Arizona. *G. p. parvidens,* xxiv, 80.
Length 1.36 to 1.55 mm., 4 to 4½ whorls; very thin and fragile; Bimini Islands. *G. p. delicata,* xxiv, 78.

GASTROCOPTA GEMINIDENS (Pils.). This species, described as a *Bothriopupa,* vol. xxiv, p. 228, is now transferred to *Gastrocopta.* It will probably form a new subgenus.

GASTROCOPTA CURACOANA Pilsbry. Text-figures 1 to 4*a.*

The shell is slender, subcylindric, slowly tapering to the obtuse summit; cinnamon brown, paler near the apex, weakly striate obliquely. The whorls are strongly convex, the last half of the last one conspicuously flattened and slightly impressed laterally over the region of the palatal fold, not crested behind the lip. The angulo-parietal lamella is strongly bifid, the parietal lobe higher, and in basal view its anterior end merges into the angular, without forming a little projection on the columellar side. The columellar lamella is strong



Figs. 1, 2.—1, 1*b*, *G. curacoana*, type. 1*a*, 1*c*, profile and basal views of opened topotype. 2, 2*a*, profile and face views of a specimen from Seroe Djerimi, Curaçao, having an infraparietal tubercle.

but does not emerge far. Its inner end turns down on the columellar axis, the whole tooth having the shape of an inverted L or the figure 7. The vertical or axial portion tapers downwards, and is fully seen only in an oblique view in the mouth, though the degree of immersion varies rather widely in different lots. The upper-palatal and the basal folds are short but well developed, usually brown-tinted. The lower-palatal fold is long, reaching to a subdorsal position. Its outer half is brownish, the inner half is higher, white and strongly curved. The peristome is brown, reflected, thickened within more or less. The parietal callus is moderately thick and very short. Dimensions variable; usually between:

Length 2 mm., diam. above aperture 0.8 mm.; 4⅔ whorls.

Fig. 1. Length 2.4 mm., diam. above aperture 0.8 mm.; 5½ whorls.

Fig. 3*a*. Length 1.85 mm., diam. above aperture 0.75 mm.; 4½ whorls.

Fig. 3. Length 2.2 mm., diam. above aperture 0.95 mm.; 5 whorls.

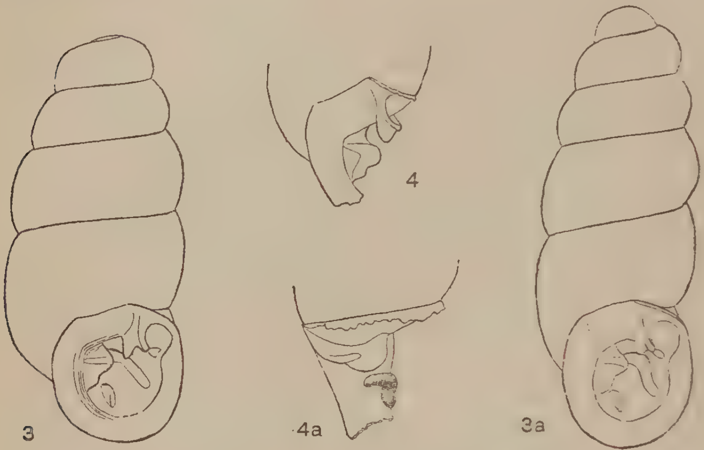
Dutch West Indies: Aruba, Curaçao, Bonaire and Klein Bonaire (H. Burrington Baker); type 133584 ANSP. from Fort Nassau, Willemstad, Curaçao.

Pupa longurio CROSSE, Journ. de Conchyl., xx, 1872, p. 158; xxi, 1873, p. 42, pl. 1, fig. 2. Not *Pupa longurio* Moquin-Tandon, Hist. Nat. Moll. France, ii, 1855, p. 379 (=*P. affinis* Rossm.).—*Gastrocopta longurio* (Crosse) PILSBRY, Man. Conch. xxiv, p. 82, translation of original desc. — *Gastrocopta curacoana* PILSBRY, Proc. A. N. S. Phila., lxxvi, 1924, p. 62, text-figs. 1-4*a*.

This variable species is related to *G. barbadensis,* but it is certainly distinct by the decidedly longer lower-palatal fold, its inner half curved downward, by various small differences in the lamellæ, and by the long, slim shape and strongly convex whorls, the last one more compressed laterally.

The slender shape, which Crosse noted in his description of *P. longurio,* is not invariable; and indeed, the shape sometimes varies notably in one colony, as in the case of the shells from Bonaire drawn in figures 3, 3*a*. The details of shape and degree of immersion of the columellar lamella also vary.

In some lots most of the fully adult shells have an infraparietal tubercle, as in figs. 2, 2*a*, the other characters remaining typical.



Figs. 3, 3*a*, 4, 4*a*—*G. curacoana,* Campo el Hato, Bonaire.

It is an abundant species, found at many localities on the islands named.

GASTROCOPTA OCTONARIA Pilsbry. Text-figs. 5 to 7*a*.

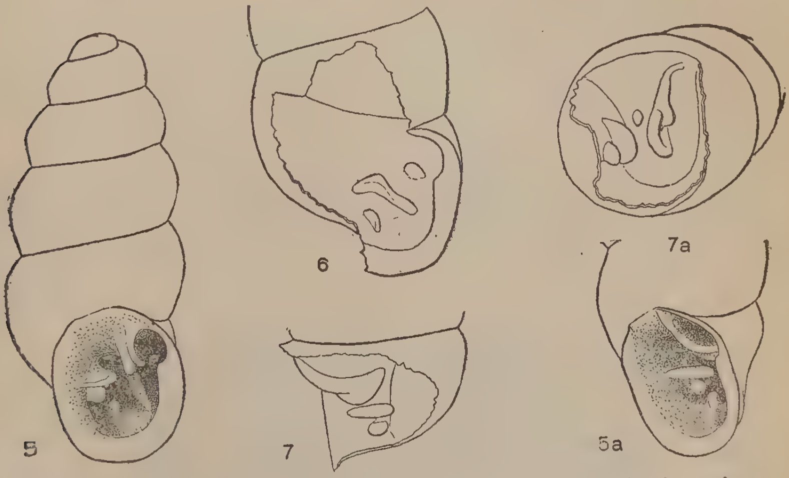
In shape this species is somewhat broader below and has a more rapidly tapering spire than typical *G. curacoana;* it is of a slightly lighter brown color, the apical whorls pale or whitish. The whorls are strongly convex. The angulo-parietal lamella is strongly bifid; in a basal view, the parietal shows no spur on the columellar side. A tubercular, rather deeply placed infraparietal lamella is present. The columellar lamella is strongly developed; below its inner end there is a strong subcolumellar tubercle, somewhat united with the columellar. The palatal folds are similar to those of *G. curacoana* in shape and positions, but they are generally white; the lower-palatal is long, the inner half curved. The peristome is reflected, thickened within except at the sinulus.

Length 2.3 mm., diam. above aperture 0.95 mm.; 5½ whorls.

Dutch West Indies: Aruba, Curaçoa, and Bonaire. Type, No. 133559 ANSP. (figs. 5, 5*a*), from Fort Nassau, Willemstad, Curaçao (Horace Burrington Baker).

Gastrocopta octonaria Pilsbry, Proc. A. N. S. Phila., lxxvi, 1924, p. 64, text-figures 5-7*a*.

While many specimens are separable from *G. curacoana* by the different shape, others are indistinguishable from the broader examples of that species. In a great number examined, the strong tubercular subcolumellar lamella is a constant differential character, being replaced in *curacoana* by a tapering buttress.



Figs. 5, 5*a*, 7, 7*a*.—*G. octonaria,* Fort Nassau, Willemstad. Fig. 6, specimen from Seroe Djerimi, broken to show the full length of the palatal folds.

The whorls of *G. octonaria* are more convex than in *G. polyptyx* Pils., of St. Thomas, and it differs further by the longer, curved lower-palatal fold, and by the larger subcolumellar lamella, which is more united with the columellar.

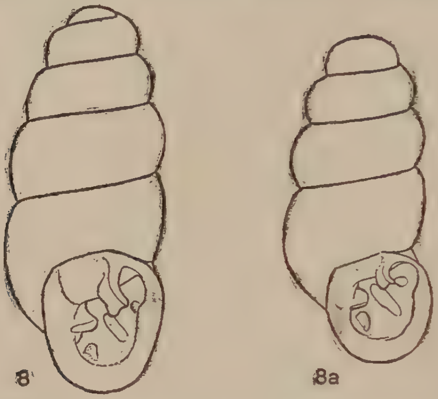
In a few lots there are beautiful albino shells.

This species was almost always found associated with *G. curacoana,* and in a few cases with *G. barbadensis hojeda* also.

G. octonaria and *G. b. hojeda* require comparison with *G. uvulifera* Guppy, of Trinidad, which has not been defined exactly enough for comparison with related species.

GASTROCOPTA BARBADENSIS HOJEDA Pilsbry. Text-figs. 8, 8*a*.

The shell is cylindroid-tapering, cinnamon brown to wood brown, the whorls convex, the last one less compressed laterally than in *G. curacoana*. The angulo-parietal lamella is bifid, but less distinctly than in *curacoana* and *octonaria;* it shows no spur on the columellar side in a basal view. The strong columellar lamella has a low tapering buttress below the inner end, not always visible in a direct front view. Upper-palatal and basal folds are small but distinct. The lower-palatal fold is straight, and *very much shorter* than in *G. curacoana* or *G. octonaria*. The reflected peristome is moderately thickened.



Figs. 8, 8*a*.—*G. barbadensis hojeda,* type and smaller topotype.

Length 2.1 mm., diam. above aperture 0.85 mm.; 5 whorls. Type.

Length 1.8 mm., diam. above aperture 0.75 mm.; 4½ whorls.

Dutch West Indies: Aruba and Curaçao (H. Burrington Baker). Type, No. 133538 ANSP., from the Tafelberg of Sta. Barbara, Curaçao.

Gastrocopta barbadensis hojeda PILSBRY, Proc. A. N. S. Phila., lxxvi, 1924, p. 65, text-figs. 8, 8*a*.

This form can be readily distinguished from other Gastrocopta of the Curaçao group by the far shorter lower-palatal fold. It differs from typical *G. barbadensis* by the simpler armature of the columella.

Vol. XXIV, page 65. G. PROCERA DUPLICATA Sterki, preoccupied, has been changed to *G. p. sterkiana,* vol. xxiv, p. 357. The type locality is Glenrose, Somerwell Co., Texas, not "Somerville" as printed in line 14 from bottom.

GASTROCOPTA PELLUCIDA PARVIDENS (Sterki), vol. xxiv, p. 80, was taken on Tortuga Island in the middle of the Gulf of California by the California Academy Expedition of 1921, according to G. Dallas Hanna, Proc. Cal. Acad. Sci. (4), xii, 1923, p. 515. B C

GASTROCOPTA RIXFORDI Hanna. Text-fig. 9.

"Shell minute, cylindric; whorls four, rounded; glossy-transparent when alive; lines of growth very fine but evenly spaced; last whorl with an expanded bulge just back of the aperture; aperture semielliptical; peristome broadly reflected but not thickened with callus; ends continuous across the body whorl; apertural armature consisting of five or six teeth, depending upon the degree of separation of the parietal (type specimen has five); upper and lower palatal very deeply seated, flat and blade-like, the latter being larger and deeper placed; basal thin, quadrangular, the axis placed parallel to the plane of the aperture, and the apex directly beneath the apex of the parietal; columellar long, slender and high, the interior termination invisible from the aperture; parietal the

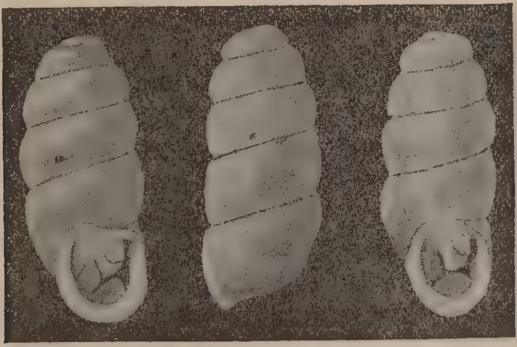


Fig. 9.—*G. rixfordi* (after Hanna).

heaviest of all, reaching nearly to the aperture; angulo parietal spur united to the parietal in the type, bending outwardly toward the aperture and merging into the posterior peristome (in the paratype figured and other specimens the angulo-parietal is separated from the parietal by a space). Altitude 2.01 mm., diameter .81 mm.'' (*Hanna*).

Montserrate Island, Gulf of California (J. C. Chamberlin). Type, No. 1094 Cal. Acad. Sci.

Gastrocopta rixfordi Hanna, Proc. Cal. Acad. Sci. (4), xii, art. 26, p. 515, pl. 10, figs. 5-8.

''In the occasional separation of the angulo-parietal tooth from the parietal, this species resembles the genus Sterkia where it is normally separated. Part of the type lots of each of the West American species of the genus, *calamitosa*, *clementina* and *hemphilli* are in the collection of the California Academy of Sciences and the possibility of their having originated from some such ancestral stock as *G. rixfordi* is suggested. On account of the color of the latter and the usual tooth arrangement (as in the type) the species is placed in the section *Albinula*. The shape of the whorl back of the aperture is strongly suggestive of the condition in *G. armifera* and *G. contracta*.

''The species is named for Dr. Emmet Rixford of San Francisco, California'' (*Hanna*).

I have not seen specimens of this species; its generic position appears somewhat uncertain.

Vol. XXIV, page 95. 12th line from bottom: For Pl. 28, figs. 1, 2, Ecuador, and pl. 28, fig. 3, Duran, read: Pl. 28, figs. 2, 3, Ecuador, and pl. 28, fig. 1, Duran.

Page 124. Pupa annobonensis Girard has been figured by Germain, Ann. Mus. Civ. Stor. Nat. Giacomo Doria, Genova, (3), vii (xlvii), 1916, p. 236, pl. 6, f. 17, 18, but the figures are too indistinct to make their reproduction here worth while. It is said to be closely related to *P. nobrei* Girard, of San Thome.

Page 128. Gastrocopta seignaciana (C. et F.). This is probably ''*Pupa leignaciana* Cross., Cayenne'' of Paetel's terrible *Catalog*, 1883, p. 159.

Page 135. GASTROCOPTA(?) BARRACKPORENSIS (Gude) has been transferred to *Nesopupa,* see vol. xxv, p. 348.

Page 138. GASTROCOPTA(?) THIBETICA (Bens.) has been transferred to *Vertigo.*

GASTROCOPTA RECONDITA (Tapp. Can.). Pl. 29, fig. 3.

Vol. XXIV, p. 153. C. R. Boettger (Abhandl. Senckenb. Nat. Ges., xxxv, Heft 4, 1922, p. 393, pl. 22, f. 26) has figured one of the original specimens; a photographic copy is here given. The aperture is not sufficiently worked up to show the relations of the species to *G. niobe, G. moellendorffiana* and others.

GASTROCOPTA MICROSOMA (Tapp. Can.). Pl. 29, fig. 9.

Vol. XXIV, page 153. A figure by C. R. Boettger (*op. cit.,* p. 394, pl. 22, f. 25) is here reproduced. Adequate illustration of the aperture is still lacking.

GASTROCOPTA NIOBE (Fulton). Vol. xxiv, p. 153.

As figured and described by Fulton, this species is elongate-oval in shape, with five teeth, thus quite unlike *G. moellendorffiana* (vol. xxiv, p. 145), which has a distinctly tapering spire and seven or eight teeth (the suprapalatal fold being either present or obsolescent). However, specimens in the Bryant Walker collection, from Tenimber Is., sent by Fulton as *P. niobe,* prove to be identical with *G. moellendorffiana.* The type of *P. niobe* should be examined; possibly it was incorrectly described and badly figured.

In one of the Tenimber Island specimens the basal fold is shorter than in my figures 12, 13 of *G. moellendorffiana.* The suprapalatal fold is well developed in one specimen, absent in another.

GASTROCORTA INSULSA Preston (vol. xxvi, p. 229). This form, which I consider a synonym of *G. klunzingeri,* has been reported from Dar-es-Salaam, Tanganyika Territory, by Connolly, Ann. Mag. N. H. (9), xv, 1925, p. 479.

GASTROCOPTA MICROBUS 'Morelet' Dautzenberg (vol. xxiv, p. 123), is considered by Connolly to be equivalent to *G. dama-*

rica (Anc.), an opinion in which M. Dautzenberg concurs. Ann. Mag. N. H. (9), xv, p. 479.

Gastrocopta madagascariensis Bavay & Germain. Text-fig. 12.

Shell small, subcylindric, narrowly umbilicate, thin, smooth, pale brown, silky. 5½ convex whorls, the first three more convex, the last wider, forming nearly half the shell. Aperture is oval, little lengthened, bitten out by the penult whorl; peristome a little reflected outwardly, the outer, basal and columellar borders continuous, interrupted at the penult whorl; lower margin rounded, columella straight, outer margin rather straightened, then inflexed. Aperture a little funnel-shaped, 5-toothed: upper palatal [angulo-parietal] tooth large, squarish, somewhat forked, entering; columellar tooth conic; lip teeth immersed, the median quite strong, the upper and lower smaller.

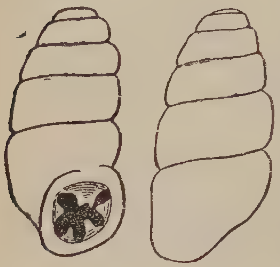


Fig. 12.

Alt. 2, diam. 1 mm. (*Bavay & Germain*).

Madagascar: neighborhood of Cape Diego (Decary).

Gastrocopta (Falsopupa) madagascariensis Bavay et Germain, Bull. Mus. Nat. d'Hist. Nat., Paris, 1920, p. 156, figs. 3, 4.

"This species recalls, by the general form and the characters of the aperture, the Gastrocoptas of the Mascarenes, notably *G. microscopica* Nevill of the Seychelles and Mascarenes. It differs mainly by the less ovate shape, the whorls less joined, the aperture less subquadrangular, and the different position of its denticulations" (*B. & G.*).

This is another member of the little group described in vol. xxiv, pp. 127-133. The characters assigned and the crude figures given scarcely serve to separate it from forms already named. The figures are here copied photographically.

Page 165, 12th line: for fig. 9, substitute fig. 7.

The following are to be added to the list of Tertiary species:

GASTROCOPTA NOULETIANA (Dupuy), vol. xxiv, p. 116. Wenz places the following in the synonymy: *Vertigo ludovici, barreri, chydæa, eucrina, tapeina, necra, cyclophora* of Bourguignat, 1881. — *Pupa buchwalderi* Heer, Die Urwelt d. Schweiz, (2), 1879, pp. 374-5, fig. 235.—*Pupa callosa* Halavats, Fauna d. Pontischen Schichten Umg. Balatonsees, in Res. wiss. Erforsch. Balatonsees, i, 1, p. 60, pl. 3, f. 9 (not of Reuss).—*Pupa longidens* and *P. miliolum* Clessin, 1912(?).

GASTROCOPTA (ALBINULA) KENNARDI L. R. Cox. Proc. Malac. Soc. London, xvi, 1925, p. 221, figs. A-E. Lower Oligocene, Tongrian: Bembridge Limestone, Whitecliff Bay, Isle of Wight.

GASTROCOPTA (SINALBINULA) MATURA L. R. Cox. Same vol., p. 224, figs. F-H. Same horizon and locality.

HYPSELOSTOMA (Vol. XXIV, p. 175).

Add to synonymy: *Hyperostoma* Simroth, in Bronn's Klassen u. Ordnungen des Tier-Reichs, iii, 1909, p. 103. Remove *Tonkinia* Mabille, known to belong to the Streptaxidæ.

Vol. XXIV, page 182. HYPSELOSTOMA INSULARUM. Reference to figures should stand: 1 to 5.

Page 183, 4th line: for 1808 read 1908.

Page 184, 7th line: for fig. 10, read fig. 9. And in 15th line, for figs. 11, 13, read 10, 11, 13.

Page 183. HYPSELOSTOMA CROSSEI; for Pl. 32, fig. 5, read Pl. 32, fig. 6.

FAUXULUS (XXIV, p. 234).

Page 246. F. FRYANUS. The name appeared as *Pupa fryali* in Zoological Record for 1864, i, p. 234, 1865.

Page 252. F. G. TOMLINI. Add the reference: [*Pupa glanvilliana* Anc.] var. *tomlini* BURNUP, Ann. Mag. N. H. (8), vii, 1911, p. 413, pl. 10, f. 7.

ABIDA Leach (Vol. XXIV, p. 262).

Additions to, and corrections of, the list of Tertiary species follow:

Page 269. The date of Abida oryza Edw. is 1852.

Page 270. Abida antiqua (Zieten). Wenz gives Zieten as authority for this species in place of Schäbler. He places *Pupa pachygastra* O. Fraas, 1882, in the synonymy, and adds the subspecies Abida antiqua grossecostata (Gottschick et Wenz), Nachrbl. d. Mal. Ges., li, 1919, p. 4, pl. 1, f. 3, from the Sarmatien, Steinheim am Albuch, Württemberg.

Abida antiqua noerdlingensis (Klein). Wenz adds the synonym: *Pupa laichingensis* Quenstedt, Petrefaktenkunde Deutschlands, Abt. 1, vol. 8, 1884, p. 85, pl. 187, f. 101.

? Abida bythiniformis (Miller). *Pupa bythiniformis* Miller, Jahresh. Ver. vaterl. Naturk. Württemberg, lxiii, 1907, p. 455, pl. 9, f. 17. Lower Eocene, Lutetien, Bachhagel, Bavaria.

Abida multicostulata (Gutzw.) (Vol. xxv, p. 4), is placed here by Wenz, who gives the horizon as Lutetien.

Abida schlosseri (Cossmann). *Pupa schlosseri* Cossm., Revue Crit. Pal., 1908, p. 257, n. n. for *Pupa (Vertigo) oviformis* Schlosser. See vol. xxv, p. 220, and xxvi, p. 232.

Abida servasensis (Fontannes). *Pupa servasensis* Fontannes, Descr. som. fauna malac. du groupe d'Aix, etc., 1884, p. 39, pl. 5, f. 33. Lower Oligocene, Tongrien: Servas, Dép. Gard. Wenz, Foss. Catal., iii, 1923, p. 946.

Abida subfusiformis (Sandberger). *Pupa (Torquilla) subfusiformis* Sandberger, Land- und Süsswasser-Conchyl. Vorwelt, 1874, p. 598.—*Pupa loxostoma* Quenstedt, Petrefaktenkunde Deutschlands, Abt. I, vol. vii, p. 85, pl. 187, f. 98.—*Pupa subantiqua* Lomnicki, Verh. k. k. geol. Reichsanst., Wien, 1886, p. 423. Upper Miocene, Tortonien: Germany, Galicia.

CHONDRINA Reichenbach.

Vol. XXV, p. 1. Add the following synonyms:

Cercon Megerle, Scudder, Nomenclator Zoologicus, 1882, p. 65 ("= Pupa").—*Pyrene* Mergele, Scudder, t. c., p. 288 ("= Pupa").—*Valgum* Megerle, Scudder, t. c., p. 349 ("=

Pupa"). Scudder elsewhere cites "*Pupa* Draparnaud" [Tableau Moll. terr. fluv. France, 1801, pp. 32, 56; Hist. Nat. Moll. terr. fluv. France, 1805, pp. 24, 59; Westerlund, Methodus disposit. Conchyl. Reg. Pal. etc., 1902, p. 105, type *P. frumentum* Drp.]. The names stated to be equivalent to *Pupa* will thus become synonyms of *Chondrina.*

CHONDRINA MEGACHEILOS (C. & J.). Vol. XXV, p. 7.

Add to synonymy: *Torquilla avena* Drap. var. a, *parva,* 6 x 2.5 mm. Var. *b, media,* 9 x 3 mm. STABILE, Fauna Elvetica: Conch. terr. e fluv. Luganese, 1845, p. 41. In a MS. note in our copy of this paper Stabile wrote that in 1845 he was a novice in science, and that the science itself had made progress since, so that numerous corrections of his early work are required; among them he lists his *T. avena* of 1845 as equivalent to *Pupa (Torquilla) megacheilos* Jan, var. *minor.* In his later work on the same fauna (Prospetto sist-statist. Moll. terr. e fluv. Lugano, 1859, pp. 52, 57) he has the following entry: *Pupa megacheilos* mut. *minor:* smaller, very close to *P. avenacea* (and on pp. 52, 58) mut. *media:* double the size, brownish corneous or blackish-brown.

CHONDRINA AVENACEA (Brug.). (Vol. XXV, p. 10.)

N. Pini (Bull. Soc. Malac. Ital., ii, 1876, p. 162) gives the following mutations of *Pupa avenacea* from the Esino region: MAXIMA: *Torquilla tricolor* Villa, Dispositio 1841, p. 57; Rossm. Icon., fig. 318. MAJOR: n. n. for typical *megachilos* Jan. MEDIA, *Torquilla avena* Auct. Lang (*albilabris* Ziegler). MINOR: *P. megachilos* var. *b*, Porro, *P. hordeum* Stud. (non Charp.), *T. hordeum* Drap. in Villa, Cat. Sin., 1871. Var. MULTIDENTATA Strobel (*circumplicata* Mouss.).

CHONDRINA SIMILIS JULIANA, vol. XXV, p. 61. Add to synonymy: *Pupa quinquedentata* var. *iuliana* de Stefani, Bull. Soc. Mal. Ital., ix, 1883, p. 126.

GRANOPUPA Bttg. Vol. XXIV, p. 332.

GRANOPUPA GRANUM (Drap.). Vol. XXIV, p. 335.

Pupa boettgeriana Clessin (see vol. xxv, p. 49) has been examined by Dr. Haas, whose report follows:

"The Clessin collection is contained in the Staatliche Naturliensammlung in Stuttgart, whence I received the type of *Pupa boettgeriana* Clessin as a loan. In the tube marked with this name there were 3 identical examples. In his original diagnosis (Mal. Bl., n. F., v. p. 188, pl. 4, fig. 4; copied in Manual, xxv, p. 49, pl. 5, fig. 3) Clessin mentioned that he possessed only *one* specimen. The exact locality is the Cerro de Albancha near Jaen, Prov. Jaen, Spain. The original label gives the name as "Pupa Böttgeriana n. sp.," but Böttgeriana is crossed out, and after n. sp., *granum* is written in Clessin's own hand. Then *granum* had been crossed out and Böttgeriana adopted again by underlining with dots.

"Clessin thus at some time had doubts as to the validity of his new species, which really is not separable from typical *Granopupa granum*.

"The three specimens all measure 5 x 1.75 mm. and have typical *granum* teeth, 1-2-4, although Böttgeriana was said by Clessin to be toothless. However, as the apertures of all the specimens were very dirty, Clessin perhaps overlooked the teeth. That the original description does not agree with the original figure was recognized, and in the case of Clessin occasions no surprise. That the original specimens are now found to agree with neither is almost a logical corollary. A re-examination of Clessin's types of *Corbicula* by Dr. Prashad of Calcutta, who worked with me for a time, demonstrated conspicuous disagreements, which almost justify the generalization that one has nothing to depend upon in dealing with Clessin's descriptions and figures."

GRANOPUPA(?) MORAGUESI (Moragues).

Shell perforate, conic-elongate, the spire tapering, apex acute; corneous; under a lens obliquely and closely rib-striate. The 5 whorls are somewhat convex, separated by a deep suture, regularly increasing, the last slightly wider than the penult, slightly ascending to the aperture and very lightly flattened behind the margin. Aperture oblique, obliquely ovate, nearly cordate, with 6 folds: two [parietal] folds, the upper short, lower long, entering; two columellars, the upper at the insertion of the columella, the lower smaller; two subequal palatals. Peristome slightly thickened, the margins joined by a thin callus, columellar margin somewhat dilated, spreading. Alt. 4 mm. (*Moragues*).

Majorca.

Pupa moraguesi Kobelt, MORAGUES, Anales de la Soc. Española de Hist. Nat., Madrid, xv, 1886, p. 235.

Nothing further is known of this form.

GRANOPUPA RHODIA TAURICA (Kessler). Pl. 31, fig. 16.

Vol. XXIV, p. 345. Retowski (Malak. Blätter n. F., vi, 25) has discussed the *Pupa taurica* Kessler (Reise nach der Krim, 1860, p. 226) originally described from the rocks at Jolta. The size was given as 5.8 x 2.1 mm., and as a further difference, the two palatal folds are of equal length in *taurica*, while in *rhodia* the lower is always shorter. Near Sudak, Retowski collected specimens of intermediate size, 5.2 x 1.7 mm., with the lower palatal fold sometimes almost equal to the upper, although it always remains a little shorter. He considers *taurica* to be specifically identical with *rhodia*.

Dr. Boettger stated that this variety is distinguished by its greater size, more convex whorls and deeper suture. He gives the localities: Sarus River drift, Adana, Cilicia; Guelek, near Adana; Kovelutza near Smyrna; Beirut and Damascus in Syria (*Modicella rhodia* Roth, var. *taurica* Kessl., Boettger, Nachrbl. D. M. Ges., 1905, p. 108).

Beirut specimens from Boettger are not larger than *rhodia*, but the whorls are distinctly more convex.

A specimen from Neshori, Macedonia (pl. 31, fig. 16), received from the Boettger collection, measures, length 5.8, diam. 2.2 mm.

GRANOPUPA BRONDELI (Bourguignat). Pl. 31, fig. 14.

Vol. XXIV, p. 346. A topotype from Pescade Point is here figured. There are small angular and parietal lamellæ and a strong columellar lamella, situated high. No palatal folds.

Length 5.3, diam. to lip edge 2.2 mm.; 6 whorls.

Some examples in the same lot are decidedly more slender.

Subfamily Vertigininæ.

VERTIGO Müller. (Vol. XXV, p. 69.)

Vertigo hoppii (Möller). Vol. XXV, p. 135.

L. Soos and H. Schlesch record this form from five places in Greenland: Kangerdluarsuk (61° 53′); Nisik, Kavssinguak and Ameralik near Godthaab; and Mudderbugton on Disko Island (69° 45′). They quote Möller's description, and continue: "Our single specimen (from Kavssinguak, fig. 13A) agrees with this description except that it has no palatal fold; its columellar lamella is represented by a very low nodule; its length 2.48, diam. 1.47 mm. Already Mörch had noted that it looks most allied to *Pupa arctica* Wallenb., and a careful comparison with specimens of this latter has shown the accuracy of Mörch's remark, as is shown by fig. 13B, the latter differing only by its having a palatal fold (which may be, however, absent), and stronger developed parietal and columellar lamellæ. According to Pilsbry, both of them may prove to be merely local races of *V. modesta*" (Ann. Mus. Nationalis Hungarici, xxi, 1924, p. 98, fig. 2).

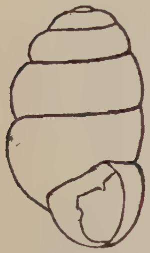


Fig. 13*a*.
V. hoppii.

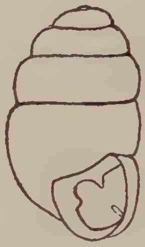


Fig. 13*b*.
V. arctica.

Vertigo genesii (Gredler). Vol. XXV, p. 204.

This species and *V. parcedentata* have been discussed by D. Geyer in Jahres-Berichte und Mittheilungen des Oberrheinischen Geologischen Vereines, n. F., ii, 1912, p. 106, pl. 7, f. 32-40. *V. genesii* is a species of wet places, associated only with other hygrophilous snails. *V. parcedentata* is held to be distinct, and a snail of dry situations. Both vary in teeth, sometimes having as many as four.

Vertigo parcedentata (Al. Br.). Vol. XXV, p. 207. Mr. B. B. Woodward has called my attention to the fact that

Pupa parcedentata Al. Braun was first defined in Braun's letter to Prof. Bronn in Neues Jahrbuch für Min., Geogn., Geol. u. Petref., 1847, p. 51, thus: "*Pupa parcedentata* Mihi (nächstverwandt mit *P. pygmæa,* aber grösser und dünnschaaliger, die Zähne bloss angedeutet; bisher bloss bei Wiesbaden gefunden)."

If this definition is considered sufficient, this Pleistocene form will stand as VERTIGO PARCEDENTATA (A. Braun), and the Recent form, *genesii* Gredler, will take the trinomial, if not considered specifically distinct.

The following corrections should be made in Vol. XXV:

Page 82. 11th line: for *parietals* read *palatals.*

Page 109. 18th line: for *Pl. 12, fig. 12* read *fig. 13.*

Page 121. After Fig. 1, *V. concinnula* Ckll., add: Willow Creek, Mogollon Mts., N. M.

Page 142. 8th line: for *elongata* (Sterki) substitute *longa* Pils. (See also vol. xxv, p. 377.)

VERTIGO ANTIVERTIGO (Drap.). Vol. XXV, p. 163.

Page 165. 3d line: for *septemdenta* read *septemdentata* Fér.

Vertigo reneana Servain (vol. xxv, p. 167) I thought might be merely *V. antivertigo.* Dr. F. Azpeitia Moros (Bol. Soc. Ibérica Cienc. Nat., xxi, 106) is inclined to view it as identical with *V. ovata,* suggesting that this American species has been accidentally colonized in the neighborhood of Zaragoza. Haas (1924) believes it to be certainly only an abnormally toothed *V. antivertigo.*

Mr. Woodward has suggested to me that *Vertigo anglica* Fér. is identical with *V. antivertigo,* since Férussac referred to *Turbo sexdentatus* (Montagu) Maton & Rackett. However, as he added a ? to the reference, it cannot serve to define his species, to which, moreover, he attributes a size greater than that Vertigo.

VERTIGO SUBSTRIATA. Vol. XXV, p. 172.

Add on p. 174: *Vertigo substriata* forma *viridina* Borcherding. "This hitherto unobserved form is distinguished from the forma typica by its almost albino coloring and the stronger striation. It lives together with the typical form in the Blumenthal Wood near Vegesack'' (Borcherding, Abhandl. naturwiss. Ver. Bremen, viii, 1884, p. 554). This is an earlier name for the albino *V. substriata* than *viridana* Lindholm, given on p. 174.

Page 173, 21st line, should read: *Vertigo 4-5 dentata* STUDER etc., the words ''and *V. 6-dentata*'' to be deleted.

VERTIGO PYGMÆA (Drap.). Vol. XXV, p. 175.

Add the synonym: *Alæa vulgaris* Leach MS. JEFFREYS, Trans. Linn. Soc. London, xvi, 1830, p. 359.

Vertigo pygmæa graellsiana Serv. Pl. 29, fig. 5. Vol. xxv, p. 183. *V. graellsiana* was considered to be a form of *V. moulinsiana* by Dr. Florentino Azpeitia Moros, in Boletin Soc. Ibérica Ciencias Naturales, xxi, 1922, pp. 101-103. Dr. Haas (Butllet Inst. Catalana Hist. Nat. (2), iv, 1924, p. 13, pl. 2, f. 7), however, calls it *V. pygmæa graellsiana*, giving a figure (which is here reproduced) of a specimen from Flix agreeing in all respects with Servain's description.

Page 167. VERTIGO LILLJEBORGI Westerlund. Pl. 29, fig. 7. This northern species has been found at Tegel, near Berlin, where it is extremely rare. It is one of the hygrophilous vertigines, according to Th. Schmierer (Archiv für Molluskenkunde, liii, 1921, p. 271). Schmierer's figure is reproduced on plate 29. The specimen measures: length 1.5, diam. 1 mm.

Mr. B. Sundler (Journ. of Conch., xvii, March, 1924, pp. 105, 106) records this species from moist meadows around the Varrunn lakes, near Boras, Sweden. Two forms occur, a four- and a five-toothed. He proposes (p. 106) the following varietal names:

Form *quadridens,* tooth formula 1–1–2.
Form *quinquedentata,* tooth formula 1–2–2.

Page 198. 15th line from bottom: after *Pupa pygmæa* var. *alpestris* insert MIDDENDORFF in place of MAACK.

No
see Geyer in
Archiv. fur Moll.
57 : 99-102

Gross Err/Ho [illegible]

VERTIGO WESTERLUNDI n. n.

Vertigo inermis (Westerlund), Vol. XXV, p. 187, originally described as *Pupa inermis,* is preoccupied by *Pupa inermis* Deshayes, 1863, and may be renamed VERTIGO WESTERLUNDI.

VERTIGO ALPESTRIS ACHEILA Serv. Pl. 29, fig. 6.

Vol. XXV, p. 202. Haas (Butllet Inst. Catalana Hist. Nat. (2), iv, 1924, p. 13, pl. 2, f. 8) ranks this as a subspecies of *V. alpestris.* While some specimens are without a cervical callus (crest), others have the typical development of *alpestris,* together with all transitions. The example figured has the callosity very weakly indicated. At Flix in the Ebre river drift.

? ? 4. 25

Page 212. 8th line: for *V. angustula* read *V. angustior.*

VERTIGO PUPÆFORMIS Poll. Vol. XXV, p. 379. First line: in place of "Pl. 5, fig. 10" substitute Pl. 11, fig. 13.

VERTIGO ZSCHOKKEI Bütikofer. Pl. 29, fig. 4.

Shell very small, ovate, ventricose, distinctly but very finely striate, glossy purplish-brown. Whorls 4½-5, strongly convex, rapidly and evenly increasing, parted by a deep suture; the last whorl rounded, occupying fully two-fifths the total length. Aperture depressed, semicircular, little excised by the penult whorl. Outer margin is quite straight, inserting in an obtuse arc. Margins approaching, joined by a weakly developed whitish callus. Deep within the parietal wall is a tooth, wanting in the younger examples. Peristome sharp, not thickened, not expanded, only on the columellar margin slightly reflected. Umbilical crevice rather large. Length 2.5, diam. 1.4 mm. Variation in size rather considerable (*Bütikofer*).

Switzerland: a high mountain form of the Engadin. On Giufplan, 2100 meters; spring near Punt Perif; Champ. lōng, 1950 meters; Lü. On the under side of pieces of rotten wood sunk deep in the moss, half in the water.

Vertigo zschokkei BUETIKOFER, Denkschr. Schweizerischen Naturforsch. Ges., lv, 1920, p. 82, pl. 2.

Vertigo zschokkei comes nearest to *V. genesii* Gredler and *V. eumicra* Bourguignat. It differs from both by the dentition, and from the last especially by the smaller size and darker color, as well as by the characters of the mouth. In habits it agrees with *Vertigo genesii (Bütikofer).*

The following Tertiary species, taken from Wenz, *Fossilium Catalogus,* are to be added to the list in Vol. XXV:

VERTIGO BIFIDA (Deshayes). Erroneously included in Gastrocopta, vol. xxiv, p. 117.

VERTIGO BRUSINAI Stefani. Atti Soc. Toscana Sci. Nat., Pisa, v, 1880, p. 30, pl. 2, f. 17 (p. 118, pl. 3, f. 17). Wenz, Foss. Cat., iii, 1923, p. 983. ? Middle Pliocene: Marciano, Prov. Perugia.

VERTIGO CALLOSA BOSNIACKII (Stefani). *Vertigo diversidens* var. bosniackii Stefani, Atti Soc. Toscana Sci. Nat., Pisa, v, 1880, p. 30, pl. 2, f. 16. ? Middle Pliocene: Marciano, Prov. Perugia.

VERTIGO CALLOSA DIVERSIDENS (Sandberger). Under this subspecies Wenz (Foss. Catal., iii, 1923, pp. 988-991) includes *V. pygmæa fossilis* and *V. antivertigo* Noulet, 1854, *V. cyclophora, campanea, sansanica, loemodonta, callostoma, codiolena, milne-edwardsi, bothriocheila, ragia, triodonta, rhynchostoma, onixiodon* and *micronixia,* all of Bourguignat (see vol. xxv, p. 219).

VERTIGO CALLOSA GLOBULUS (Deshayes). Vol. XXV, p. 218. This includes *Pupa munieri* Desh. and *P. fischeri* Desh. (formerly placed by me in *Gastrocopta,* vol. xxiv, p. 117), according to Wenz, Foss. Catal., iii, p. 991.

VERTIGO CALLOSA PERARMATA Gottschick et Wenz. Nachrbl. D. Mal. Ges., li, 1919, p. 15, pl. 1, f. 34, 35. Upper Miocene, Sarmatian: Steinheim am Albuch.

VERTIGO CALLOSA STEINHEIMENSIS Gottschick et Wenz. *Loc. cit.,* p. 15, pl. 1, f. 32, 33. Same locality.

VERTIGO NOULETI Michaud, Journ. de Conchyl., x, 1862, p. 77, pl. 4, f. 1.—Wenz, Foss. Catal., iii, 1923, p. 998. Middle Pliocene, Plaisancian: Montpellier etc.

Vertigo protracta suevica Gottschick et Wenz, Nachrbl. D. M. Ges., li, 1919, p. 21, pl. 1, f. 40, 41. Upper Miocene, Sarmatian: Steinheim am Albuch.

Vertigo (Vertilla) angulifera milleri Gottschick et Wenz, Nachrbl. D. M. Ges., li, Jan. 1919, p. 21, pl. 1, f. 38, 39. —*Vertigo peraperta* Pils., Manual, vol. xxv, p. 219, June 1919.

Vertigo miliolum (Sandberger). *P.[upa] miliolum* Sandb., Land- und Süsswasser-Conchyl. Vorwelt, 1874, p. 550.—*Vertigo (Vertigo) sandbergeri* Wenz, Fossilium Catalogus, iii, 1923, p. 1002. Upper Miocene, Tortonien: Sansan; various places in Galicia.

Wenz has renamed this species, supposing the original name to be preoccupied by A. d'Orbigny; but *miliola* Orb. was described originally as a *Helix* and now belongs to *Gastrocopta*, so there was no real preoccupation, and Sandberger's *miliolum* will stand.

Vertigo vectensis L. R. Cox. Proc. Malac. Soc. London, xvi, 1894, p. 123, figs. A, B, C; same vol., 1925, p. 225, figs. I–L. Lower Oligocene, Tongrian: Bembridge Limestone, Whitecliff Bay, Isle of Wight.

Vol. XXV, p. 216, line 3: for "et" read de.

PARACRATICULA Oppenheim.

Paracraticula Oppenh., Denkschr. K. Akad. Wissensch., vol. 57, 1890, p. 126, for *Pupa (Paracraticula) umbra* Oppenh., l. c., pl. 3, f. 10-10*b*; Zeitschr. Deutsch. geol. Ges., vol. 47, 1895, p. 104. See also the synonym *Pupa turcica* var. *singularis* De Gregorio, Ann. de Géol. et de Pal., x livr., pp. 19, 25, pl. 2, f. 17.—*Paracraticula umbra* Wenz, Foss. Cat., ii, p. 733. Middle Eocene of Pugniello, prov. Vicenza, Italy.

The type and only species of this group is a minute form, about 1 mm. long, having a strongly defined sinulus and numerous lamellæ, as shown in pl. 29, figs. 1, 2, reproduced from Oppenheim. It has been considered a Streptaxid snail near *Ennea* by some authors, but appears far more likely to be a specialized form related to *Ptychalæa, Glandicula* etc. and thus belonging to the Vertigininæ.

GLANDICULA (Vol. XXV, p. 221).

GLANDICULA TIARULA (Sandberger). Vol. XXV, p. 221. *Pupa turcica* Deshayes is considered a synonym by Wenz, Foss. Catal., iii, 1923, p. 1011. The form described as *Pupa turcica* var. *singularis* de Gregorio, Ann. de Géol. et Pal., 10 Livr. 1892, p. 19, pl. 2, f. 17, is a synonym of *Paracraticula umbra* (Oppenh.).

ENNEOPUPA (Vol. XXV, p. 222).

Sandberger's figures, copied in Vol. XXI, pl. 5, f. 12, do not give an adequate idea of *E. cylindrella,* the type of this Upper Oligocene genus. New figures are given, pl. 29, figs. 13, 14, from a Hochheim-Floersheim specimen.

The cylindric shell is ribbed excepting 1½ smooth initial whorls. The angular lamella is represented by a nodule in the usual place on the raised parietal margin of the peristome, and a short, very deeply immersed lamella widely separated therefrom. Parietal lamella is also placed deeply. The strong columellar lamella runs upward within the dorsal side, and there is a well-developed subcolumellar lamella. The posterior margin of the peristome is completely developed. The specimen figured is 3 mm. long.

The structure of the angular lamella and of the peristome show this to be a rather highly evolved snail, of which the affinities are not clear. While it may possibly belong in the Vertigininæ, I am more disposed to view it as a lateral branch of the ancestral stock of *Agardhia.*

ENNEOPUPA CYLINDRELLA (Sandberger). Pl. 29, figs. 13, 14.

Wenz (Foss. Catal., iii, p. 1012) places *Pupa coarctata* Deshayes, Descr. An. s. Vert. Bassin Paris, ii, 1863, p. 856, pl. 56, f. 13-15, in the synonymy. Upper Oligocene, Chattien, Calcaire d'Etampes; Landschneckenkalk of Hochheim-Flösheim, Hessen-Nassau.

An allied form, not named, has been reported from the Upper Miocene of Oppeln, Silesia.

LYROPUPA (Vol. XXV, p. 226).

(By H. A. Pilsbry and C. Montague Cooke.)

Renewed search in the Museum of Comparative Zoology by one of us (C. M. C.) brought to light Pease's type lots of *Vertigo striatula* and *V. costata*, which at the time we discussed *Lyropupa* had been reported as lost.

Lyropupa striatula (Pease). Pl. 28, figs. 1, 2.

See Manual, xxv, p. 246, for original description. A cotype from 45234 M.C.Z. here figured is cylindroid-tapering, widest at the last whorl, dull chestnut-brown with a pale peripheral band, strongly ribbed, about 5 ribs in 1 mm. on face of the last whorl. Surface but slightly shining, showing weak, fine raised spiral striæ between the ribs; on the last whorl above the sulcus about 14 of these striæ may be counted. The whorls are very strongly convex, the last half-whorl tapering downward, having a spiral median impression running to the lip, and on the back a deeper short impression running obliquely downward and forward from it. Angular lamella thin and high. Parietal well developed. Columellar deeply immersed. Upper-palatal fold emerging, entering deeply. A low, wider, lower-palatal somewhat diverging forward from the upper, is visible in the throat. Length 2.45, diam. 1.4 mm.; 5½ whorls.

Hawaii: Kalapana, Puna (Pease).

This species stands very close to *L. clathratula* (Anc.), differing by the deeper furrows on the back of the last whorl and the more numerous spiral threads. These are also weaker, but since they are largely cuticular in *L. clathratula*, their weakness in this cotype of *L. striatula* may be due to wear. For the present we allow both to stand as species.

Lyropupa costata (Pease). Pl. 28, figs. 6, 7, 8.

The original description has been reproduced in Vol. XXV, p. 272.

The cylindric shell is strongly ribbed after the smooth 1½ earliest whorls, the ribs narrow, somewhat flexuous, in the last two whorls often weak or sometimes interrupted in the middle. The last half-whorl has one long and two short spiral furrows. The ribs extend over the base. The aperture has the usual angular and parietal lamellæ. The columellar lamella is readily visible in a front view. The upper-palatal is conspicuous, as usual. Below it, and somewhat immersed, the lower-palatal is seen. The basal fold is represented by a low tubercle below the inner end of the lower-palatal fold.

Length 2.3, diam. above aperture 1.1 mm.; 5 whorls.

Hawaii (Pease, No. 45327 M.C.Z.); Kona crater (Thwing). Waiaha (A. Gouveia). Also Kahoolawe, Lanai and Molokai.

Vertigo costata Pease, Proc. Zool. Soc. London, 1871, p. 461; reproduced in this work, vol. xxv, p. 272. — *Lyropupa kahoolavensis* Pilsbry and Cooke, Man. Conch., xxv, p. 256.

By external characters this species is likely to be mistaken for *L. ovatula kona*, but the palatal structure is quite distinct.

Pease's description was altogether insufficient for the recognition of the species, and in fact is inaccurate; but as his types have been found it seems best to recognize this widely-spread snail under his name.

LYROPUPA OVATULA KONA Pils. and Cooke. Pl. 28, figs. 9, 10, 15, 16, 17.

Vol. XXV, p. 266, exclusive of pl. 26, fig. 5, and the locality Moomomi, Molokai.

New figures are given of the type from Huehue (figs. 9, 10, 15) and specimens from Kapulehu (figs. 16, 17). While this form is closely related to *L. ovatula* of Oahu, it differs by having a distinctly ribbed base, three distinct impressions over the palatal folds, and the basal fold is well developed. In some cases the lower-palatal and basal folds are more or less contiguous and united, as in fig. 15, a Huehue specimen, but usually they are quite separate, as in figs. 16, 17, Kapulehu. The diagrams of palatal structure, figs. 15, 16, 17, were inadvertently reversed by the artist.

The Kapulehu form has a deeper constriction of the last whorl than the type form from Huehue, and the ribs are strongly developed and even.

LYROPUPA OVATLUA MOOMOMIENSIS Pils. & Cooke, n. subsp. Pl. 28, figs. 3, 4, 5.

The last two whorls of the oblong shell are about equal in diameter. The last whorl tapers downwards and in its last half has a deep spiral furrow in the position of the upper-palatal fold; below it a much shorter furrow at the basal fold. The base is narrowly rounded, costate. The angular lamella and upper-palatal fold emerge to the peristome; parietal lamella is low. Columellar deeply immersed but visible as a broad vertical plate in an oblique view in the mouth. The strong lower-palatal fold and a lower basal fold are visible deep within in a somewhat oblique view, fig. 5. Length 2.2, diam. above aperture 1.2 mm.; 5½ whorls.

Molokai: Pleistocene or later, Moomomi. Type 44762 ANSP.

Lyropupa ovatula kona, Moomomi specimen, P. & C., Man. Conch., XXV, p. 267, pl. 26, f. 5.

The type of this species, formerly referred by us to the Hawaiian subspecies *L. ovatula kona*, was somewhat obscured by hard material. On removal of this it became evident that our decision was erroneous. The form is most nearly related to *L. ovatula* of Oahu, differing by the smaller parietal lamella and details of the last whorl and base, as shown in the figures now given.

Genus PTYCHALÆA Boettger.

Vol. XXV, pp. 157, 220, 273. The type species, *P. flexidens* (Reuss), of the Lower Miocene (Burdigalian) of Tuchorschitz is figured (pl. 29, fig. 8) from a specimen supplied by W. Wenz. The species *flexidens* and *capellinii*, with their subspecies, from the Lower Miocene to the Upper Pliocene, belong here. In the recent fauna, the Bonin Island *P. dedecora* (Vol. XXV, p. 158) is the only known species of exactly this type. It appears to me that though the shell is otherwise wholly Vertigo-like, the strong angular lamella well connected with the peristome differentiates the group sufficiently from *Vertigo*. It stands between *Vertigo* and *Nesopupa*, having the teeth of *Nesopupa* proper, while the rest of the shell, the shape and smooth surface, is that of *Vertigo*. To unite the three groups into one genus would obscure what vision we have of their evolution, so that for the present I incline towards recognizing both *Ptychalæa* and *Nesopupa* as genera.

NESOPUPA (Vol. XXV, p. 274).

NESOPUPA (cfr. *micra*), Tera van Benthem Jutting, Treubia VI, livr. 2, Feb. 1925, pp. 140, 143, fig. 1, is a species found on the eastern part of Krakatau Island by Dammerman in 1920. It is said to resemble *N. micra* of Mauritius, a form of somewhat uncertain generic position, and which has not been exactly described or figured (see MANUAL, XXV, p. 351). The figures of the Krakatau form look like *Gastrocopta; cf.* MANUAL, XXIV, pl. 23, 24.

NESOPUPA BANDULANA Connolly. Pl. 29, fig. 15.

Shell minute, ovate, thin, smooth, glossy, semi-transparent, dark corneous-brown. Spire moderately produced, sides convex, apex rounded. Whorls 4½, moderately convex. Apex faintly microscopically punctate, later whorls sculptured with the same faint punctation and very faint, comparatively distant, slightly oblique, transverse striæ, hardly apparent under 50-fold magnification. Suture simple, shallow. Aperture quadrate, narrowing and rounded at the base, with a pronounced sinus at the top of the outer lip; peristome white, very slightly thickened; columellar margin a little reflexed; dental processes six: a deep-set, in-running, mid-parietal plait; a smaller one, a little nearer the surface, half way between the last mentioned and the outer lip; three rather deep-set, equidistant, basal denticles, and an equally deep-set horizontal lamella on the columella. Rima of moderate size. Long. 1.5, diam. maj. 1.0 mm. (*Connolly*).

Length 1.75, diam. 1.2 mm.; paratype.

Portuguese Southeast Africa: near Bandula Siding, B. & M. Railway (B. F. McDowell).

Nesopupa bandulana CONNOLLY, Ann. Mag. N. H. (9), ix, July 1922, p. 119.

Here figured from a paratype supplied by Connolly. It is remarkably like a *Vertigo*, but the strength of the angular lamella and its connection with the peristome by a callus (though very slight), are characters of the *Ptychalæa-Nesopupa* series. It is not an *Afripupa*. I have suspected that it might be referable to *Ptychalæa;* the shape and gloss of the smooth shell, the biarcuate outer lip and the arrangement of teeth all favor this view. But if it belongs to *Ptychalæa,* it has lost the special character of that group—the very strong connection of angular lamella with peristome. For the present, therefore, it is left in *Nesopupa.*

Section *Nesopuparia* n. sect.

Large Nesopupæ of conic shape with a long umbilical suture; aperture about as in *Nesopupa* proper. Type *N. norfolkensis* (Sykes).

NESOPUPA NORFOLKENSIS (Sykes). Pl. 29, fig. 16.
Vol. XXV, p. 333.

The conic-ovate, sinistral shell has a minute perforation and long umbilical rimation. Sculpture of delicate, very oblique, partly epidermal riblets, worn off in front of the aperture. Under the microscope the intercostal spaces are seen to be minutely roughened as by shallow, irregularly anastomosing pits. Isabella-colored, somewhat gleaming. The whorls are moderately convex, the last without impressions back of the lip, rounded basally. The aperture has 8 teeth. Angular lamella strong, curved, joining the outer lip. Parietal lamella is more immersed, straight. There is a minute tubercular or oblong infraparietal lamella. The columellar lamella is nearly horizontal, but ascends slightly as it enters. The basal fold is small and short, subcolumellar in position. Lower-palatal fold decidedly larger than the upper; above the latter is a small, tubercular suprapalatal fold. The lips are well expanded, thin, colored like the shell, their insertions remote.

Length 3.85, diameter above aperture 2.1 mm.; 5½ whorls.

Norfolk Island, on bark of Dracena.

Vol. XXV, page 344. 9th line from bottom: for *Jaminea* read *Jaminia.*

Page 352. NESOPUPA MINUTALIS (Morel.). Mayotte specimens in the Bryant Walker collection are distinctly and densely pitted, as in *N. malayana,* from which this species appears doubtfully distinct.

Page 362. 5th line from bottom: In place of "fig. 14" read fig. 12.

PUPISOMA Stol. Vol. XXVI.

Page 24. Pupisoma lignicola mut. *unidentata* was described as var. *unidentata* in Land and Fresh Water Moll. India, II, 1910, p. 300.

Helix caratalensis Tate, Venezuela, Guyana (Ann. Mag. N. H., (4), iv, Nov. 1869, p. 356), was mentioned as belonging to the group including *H. cæca* Guppy, *ierensis* Guppy and others, but it has not been otherwise defined.

Certain species from Java and Japan described as *Acanthinula* require comparison with *Pupisoma.* I do not have access to specimens, and they have not been figured. See pages 194, 198.

PUPISOMA ORCULA (Bs.).

Vol. XXVI, p. 31. Specimens which appear referable to this species were found in shell debris dug by Spalding and Pilsbry from the well-known boulder ledge at Rocky Hill, Manoa Valley, Honolulu. The spire is unusually low. Striation distinct. Faint spiral lines are discernible on the base. The most perfect one measures: alt. 1.7, diam. 1.9 mm.; 3½ whorls.

BOTHRIOPUPA Pilsbry. Vol. XXIV, p. 226.

Further consideration of the characters of this group causes me to transfer it to the Vertigininæ, where it is thought to be related to *Nesopupa* and *Pupisoma.* The species *B. geminidens,* which formerly influenced me to place the genus in the Gastrocoptinæ, is now to be transferred to *Gastrocopta.*

CYLINDROVERTILLA Bttg.

Vol. XXVI, page 45. 12th line from bottom: for *Pupa kingsi* read *Pupa kingi.*

TRUNCATELLINA Lowe. Vol. XXVI, p. 58.

TRUNCATELLINA CYLINDRICA (Fér.), Vol. XXVI, p. 65, 7th line from bottom: for Pl. 8, figs. 1-4, 8, substitute Pl. 8, figs. 3, 4, 8.

TRUNCATELLINA RIVIERANA (Bs.). Vol. XXVI, p. 71.

Gredler, in Verh. Zool.-Bot. Ver. Wien, VI, 1856, p. 114, refers to an earlier publication of *Pupa strobeli* in his Bemerkungen ueber einige Conchylien der Gattungen Pupa und Pomatias, in the Program Obergymnas. Botzen, III, 1853, page not given. I have not seen the work, and do not know whether a diagnosis was given, but the name is anterior to *P. rivierana* Bens.

Mme. Paulucci (Bull. Soc. Malac. Ital., XII, p. 40) preferred the name *P. callicratis* Scacchi, 1833. Benoit (Nuovo Catal. Conch. terr. e fluv. Sicilia, 1881, p. 100) recognized Scacchi's species; and Westerlund considered it practically equivalent to *P. strobeli.* See Vol. XXVI, p. 75. On the whole, it will probably be best to call the species TRUNCATELLINA CALLICRATIS (Scacchi).

The account of De Stefani's varieties quoted from Westerlund in Vol. XXVI, p. 75, contains several errors. The following is from De Stefani's publication, which we now possess.

Vertigo callicratis forma *nodosaria* De Stefani (Bull. Soc. Malac. Ital., IX, 1883, p. 141, not 182, as in Vol. XXVI, p. 75) is thus defined:

Differs by the more convex whorls separated by a deep suture; peristome whitish, more solid, more expanded and like a little ear; columellar lip less depressed in the middle, more straightened. 3 solid teeth deep in the throat, in the palate, the columellar lip and in the outer lip. Length 2, width 0.9 mm. Sassorosso, Appenines, and Mura di Castelnuovo, Alps.

Subvar. *marcuccii* (page 142): Shell more lengthened, the whorls less convex. Length 2.03, width 0.9 mm. Mura di Castiglione; Sassorosso. (This name was given by Westerlund as *maruccii*).

Subvar. *simii:* Differs by the smaller shell, more obese and convex; aperture toothless. Length 1.5, width 0.8 mm. Bozzano.

Benoit's account of "*Helix zanelliana* Testa" (*Helix zanellia* Testa, Due nuov. Conch. in Oreteo, 1842, No. 6, f. 2) appears to apply to the young of a *Truncatellina*. See Illustr. sist., crit., icon. Test. estramar. Sicilia ult., p. 195, pl. 5, f. 10. Benoit has also a var. *minutissima,* p. 196, with the synonym *Helix deshayesii* Calcara, 1841. When a Sicilian conchologist gets a small shell, look for trouble. The combination is inauspicious.

Pupa minuta Studer, Vol. XXVI, p. 73, was probably *strobeli,* as it was placed in the division with toothed apertures; but the definition by a reference to Draparnaud makes it include *cylindrica* also. Westerlund included it as a synonym of "*minutissima,*" that is, *cylindrica*. The propriety of using *minuta* Stud. for the present species is further questionable for the reason that *Helix minuta* Müller (Hist. Vermium, II, 1774, p. 101) was possibly a *Truncatellina,* though the description is insufficient for identification.

TRUNCATELLINA RIVIERANA LAEVESTRIATA (Ret.). Differs from the type by having the shell not ribbed.

The single example found differs so much by the almost smooth shell from the ribbed parent form that it deserves to be a special variety. All three teeth are more weakly developed than in the typical form, but this may be merely individual. From the immediate vicinity of Novorossiisk, Caucasus.

Pupa (Isthmia) strobeli v. *laevestriata* RETOWSKI, Bull. Soc. Imp. Nat. Moscou, Année 1888 (1889), p. 284.

TRUNCATELLINA BRITANNICA Pils.

Vol. XXVI, p. 77. This species has been discussed by Kennard & Woodward, Proc. Malac. Soc. London, XV, Oct. 1923, pp. 294-298, who conclude that it is quite distinct from *T. cylindrica*. They record it from the counties Devon, Dorset, Hants (Isle of Wight), Yorks.; Holocene of Kent and Norfolk; Pleistocene of Cambridge and Kent.

The original spelling "*brittanica*" was a pen or typographical error.

Page 79. 8th line: The date should be 1823; Nilsson's work was predated. See Proc. Malac. Soc. Lond., XVI, p. 23.

Page 81. TRUNCATELLINA CLAUSTRALIS CLAVELLA (Reinh.). In a specimen from Albastuman no teeth are visible in a direct face view, but three appear in an oblique view (pl. 29, fig. 12).

Page 81. *Truncatellina c. salurnensis.* The reference to the synonym *Pupa gredleri* Reinhardt is Jahrb. D. M. Ges., IV, 1877, p. 87. It is mentioned as a label name which had been used for *T. c. salurnensis.* Not *Pupa gredleri* Clessin.

Page 82. 3d line from bottom: for "Vert." read Verh.

Page 86. TRUNCATELLINA LARDEA (Jickeli). Pl. 29, fig. 11. A specimen collected by Jickeli is figured. It measures, length 1.4, diam. 0.8 mm.; 5 whorls. There are about 20 riblets in one mm. on the face of the last whorl.

NEGULUS (Vol. XXVI, p. 101).

Add the following to the list of Tertiary species, p. 104:

NEGULUS SUTURALIS (Sandberger). Wenz (Foss. Catal., iii, p. 1025) gives as synonyms: *Pupa edentata* Deshayes, Descr. An. s. Vert. Bassin Paris, ii, 1863, p. 850, pl. 56, f. 28-30.—*Pupa anoplostoma* Bayan, Etudes faites dans la coll. de l'école des Mines sur foss. nouv. ou mal con., 2 fasc. 1873, p. 93.

NEGULUS BUXOVILLANUS (Andreæ). *Pupa buxovillana* ANDREÆ, Abh. Geol. Spezialk von Elsass-Lothr., II, 3, 1884, pp. 47, 62, pl. 2, f. 1*a-c.*—*Negulus b.*, WENZ, Foss. Cat., 1923, p. 1023. Lower Eocene, Lutétien: Süsswasserkalk, Buchsweiler, Alsace. "Possibly identical with *N. novigentiensis*" (Wenz).

NEGULUS(?) NOVIGENTIENSIS (Sandberger). *Pupa (Vertigo) novigentiensis* Sdbg., Land u. Süsswasserconchyl. Vorwelt, 1872, p. 231, pl. 13, f. 22. Lower Eocene, Lutétien: Dep. Aube, Seine-et-Marne and Aisne. Wenz (Foss. Cat., p. 1023) considered the systematic position uncertain.

Page 105. NEGULUS RARICOSTA (Slavik). The spelling "*raricostatus,*" of Wenz, Foss. Catal., iii, 1923, p. 1024, is an error or emendation. Slavik's name was *Pupa (Pupilla) raricosta* on pp. 266, 272, and on the plate of his work.

Genus COLUMELLA Westerlund.

Sphyradium (Agass.) Charpentier, WESTERLUND, Fauna Palaärctischien Region Binnenconchylien, III, 1887, p. 125.—STERKI, Nautilus, X, 1896, p. 75. — HANNA, Proc. U. S. Nat. Mus., vol. 41, p. 371 (monograph, anatomy); and of most recent American and European authors. Not *Sphyradium* as limited by von Martens, 1860.

Paludinella LOWE, P. Z. S. 1854, p. 206, type *P. edentula* Drap. Not *Paludinella* Pfeiffer, 1851. — *Paludellina* TRYON, Struct. and Syst. Conch., III, 1884, p. 72, error for *Paludinella.*

Edentulina CLESSIN, Deutsche Excursions-Mollusken-Fauna, 1876, p. 208, for *Pupa inornata* = *P. edentula* Drap. Not *Edentulina* Pfeiffer, 1855 (*Streptaxidæ*).

Columella WESTERLUND, Fauna Europæa Moll. Extramar. Prodromus, fasc. II, p. 193, 1878, type *Pupa* "*inornata* Mich." = *edentula* Drap. — PILSBRY, Nautilus, XXVI, 1912, p. 60. —H. WATSON, Proc. Malac. Soc. Lond., XV, 1923, p. 275 (anatomy).

The shell is cylindric or cylindric-tapering with obtusely conic summit and distinctly perforate axis, brown and nearly smooth, composed of 5 to 9 convex whorls. Aperture subbasal, semicircular, oblique; peristome thin and sharp, the outer lip not expanded, regularly arcuate; columellar margin dilated.

The foot is short, oval, without pedal grooves, above with a coarse-meshed network of impressed lines. There are no lower tentacles.

Kidney in form of a long slender pouch, the glandular matter evenly distributed over the inner surface, not arranged in longitudinal ridges as in Pupillidæ. Ureter direct, opening into the anterior end of the pallial cavity.

Genitalia about as in Vertigo, but the penis is smaller and without glandular tissue. Atrium very short. The penis is small, slender anteriorly, bearing the vas deferens and retractor muscle at the apex. There is no appendix. The ovotestis is composed of a single mass of grape-like follicles, as in *Vertigo*. The spermatheca has a rather long, slender duct.

The jaw is wide, arcuate, composed of about 16 rhomboidal, overlapping plates, not closely united, but not wholly unconnected as in *Punctum*.

The radula of *C. edentula* has about 42 teeth in a transverse row. Centrals are tricuspid, side teeth bicuspid, the cusps subequal, short; basal plates of all but the outermost teeth are long, as in *Punctum*. There is no distinct differentiation into lateral and marginal teeth.

Type: *C. edentula* (Drap.).

Columella is widely spread in the Palæarctic Region of Europe and Asia, eastward to Japan, with four species in North America, one as far south as Nicaragua. Two Hawaiian species seem by conchological criteria to belong to the genus, but until confirmed by anatomic examination their position appears uncertain. The anatomy is known only in *C. edentula*.

C. edentula was formerly considered a Pupa or Vertigo. Sterki (1896, 76) described the jaw and teeth, pointing out similarity to *Punctum*. His description has been corroborated by Professor Gwatkin (1897, 227, fig. 1) and by Miss Breen (Hanna, 1911, 372), and the subject has been ably considered by Hugh Watson (1923, 275, 279), who concludes that the jaw of *Columella* "seems to differ from that of *Vertigo* in that the oblong plates of which it is composed are less closely united with one another." The genitalia were found by Hanna and Watson to be much as in *Vertigo* and *Truncatellina*. It differs from *Vertigo*, as Hanna writes, "in having no teeth in the aperture of the shell, and the peristome thin and without a callus deposit. Also the surface of the foot is covered with a network of incised lines, which are not found in any of the species of *Vertigo* examined by the writer. It is allied to this genus by the animal lacking a lower pair of tentacles and by the vas deferens being attached to the apex of the penis, not down on its side as in *Bifidaria* [*Gastrocopta*] or *Pupoides*."

C. edentula has been reported from the English Upper Pliocene, and Pleistocene of Europe and the United States, but the genus has not been positively identified from earlier formations. ISTHMIA DUBIA Newton and Harris, Proc. Malac. Soc. London, I, 1894, p. 72, pl. 6, f. 5, from the Oligocene of Headon Hill, was considered congeneric with *C. edentula* by its authors, perhaps correctly, but the figure of the shell is more that of *Vertigo.*

The species are grouped geographically, thus:

1. Species of the Atlantic Islands, Nos. 1, 2.
2. European and Asiatic species, Nos. 3-6.
3. American species, Nos. 7-11.
4. Hawaiian species, Nos. 12-14.

1. *Species of the Atlantic Islands.*

1. COLUMELLA MICROSPORA (Lowe). Pl. 30, figs. 2, 3, 4.

Shell minute, distinctly perforate, ovate-conic, somewhat trochiform or turbinate, short, very obtusely obsoletely substriate, brownish-corneous. Whorls 5, convexly swollen, the last obtusely angular with abruptly truncate or somewhat flattened base; suture impressed. Aperture depressed, transversely semioval, wider than long, occupying one-third of the total length, wholly toothless; columella with a reflected lamina; peristome equally arcuate-rounded throughout, simple, acute. Length 1¼ to 1½, diam. 1 to 1¼ mm.; apert. ⅓ to ½ mm. long; 5 whorls (*Lowe*).

Length 1.9, diam. 1.35 to 1.45 mm.; 5½ whorls (Madeira).

Madeira: at high elevations on ferns and grass stems in moist, cloudy spots in wooded regions; Lombarda das Vacas, at the Fanal, the Montado dos Peceguiros, S. Antonio da Serra and many other places (Wollaston).

Azores: S. Miguel, Fayal and Pico, in the Caldeiras and among fallen leaves of *Persea azorica* (Morelet and Drouet).

Canaries: Teneriffe at Las Mercedes, Ycod el Alto etc. Palma, on the ascent to the Cumbre above Buenavista; obtained from the fronds of ferns by sweeping (Wollaston).

Pupa microspora LOWE, Ann. Mag. N. H., IX, 1852, p. 275;

Proc. Zool. Soc. Lond., 1854, p. 207.—Pfeiffer, Monogr. Hel. Viv., III, 1853, p. 532.—Morelet, Hist. Nat. Açores, 1860, p. 197, pl. 5, f. 1. — Mousson, Faun. Malac. Canaries, 1872, p. 124.—Wollaston, Testacea Atlantica, 1878, pp. 43, 207, 449. —*Pupa edentula* var., Paiva, Mon. Moll. Mader., 1867, p. 119. —Watson, Journ. de Conchyl., 1876, p. 223.

This species is readily distinguished from the continental *C. edentula* by the striate surface as well as by the somewhat different shape, which Lowe, with some exaggeration, termed trochiform. This term is applicable to the young stages, which have a somewhat flattened base and subangular last whorl, but fully mature shells become more rounded. The typical form from Madeira is smaller than *edentula.*

Specimens seen from the Canaries (pl. 30, fig. 4, Tenerife) are larger than any of the numerous series from Madeira (figs. 2, 3). One from Las Mercedes, Tenerife, measures: length 2.25, diam. 1.6 mm., 5¾ whorls (fig. 4). Those from the Azores (Morelet) do not appear to differ from the Madeirans.

2. Columella limnæana (Lowe). Pl. 30, fig. 1.

Shell distinctly umbilicate, bulimiform, subpyramidal-ovate or ovate-turrite, rather ventricose, obtusely, closely substriate, thin, fragile, pellucid, pale corneous-yellowish. Five convexly swollen whorls, the last ventricose, produced downward; suture impressed. Aperture oblique, oval, longer than wide, two-fifths to a half of the total length, wholly toothless; columellar plate expanded and reflected over the umbilicus, sinuate, a little convex in the middle; peristome very narrowly expanded, nearly simple, acute, somewhat sinuate above. Length 2.5 to 2.75, diam. 1.5 to 1.75 mm.; aperture 1 to 1.25 mm. long (*Lowe*).

Length 2.8, diam. 1.9, aperture 1.2 mm; 5 whorls.

Madeira: in moss on the trunks of laurels (Lowe); S. Antonio da Serra, Lombarda das Vacas, Ribeiro Frio and Boa Ventura, on trunks of laurels and among fronds of moist ferns, in damp, sylvan districts of an intermediate and lofty elevation (Wollaston).

Pupa limnæana Lowe, Ann. Mag. N. H., ix, 1852, p. 275;

Proc. Zool. Soc. Lond., 1854, p. 206. — Paiva, Mon. Moll. Mader., 1867, p. 117. — Pfr., Monogr., iii, p. 531; iv, 663.— Wollaston, Testac. Atlantica, p. 208.

The rather broad, inflated, rounded-ovate, or somewhat globose, Limnæus- (or, rather, Paludina-) like form of this remarkable Pupa, in conjunction with its few and ventricose volutions (which are densely but very finely striated), its pale, yellowish-cinereous hue (often becoming whiter towards the more or less decorticated apex), its comparatively thin, fragile substance, and its perfectly edentate aperture and unthickened lip, will at once separate it from its allies (*Wollaston*).

The first 1½ whorls are smooth, the rest very finely, closely striate, the striæ rather sharp or in places partly effaced. This species differs so much from the other Columellæ that it is rather doubtful whether it belongs to that genus. Figured from a specimen collected by Wollaston.

2. *European and Asiatic species.*

3. Columella edentula (Drap.). Pl. 30, figs. 9, 10, 11.

The shell is perforate, oblong-ovate, tapering above, cylindric in the lower two whorls, or tapering slightly from the last whorl, the summit rounded; thin; cinnamon or a little darker colored, sometimes having some whitish streaks; glossy, nearly smooth, but under the microscope showing some irregular wrinkles of growth. The whorls are convex, the last two rather strongly so. Aperture oblique, rounded, truncate by the preceding whorl, toothless. Peristome with thin, sharp, unexpanded outer margin, the columellar margin reflected; margins remote.

Length 2.5, diam. 1.3 mm.; 6 whorls. Calvados.
Length 2.2, diam. 1.3 mm.; 5⅔ whorls. Calvados.
Length 2.3, diam. 1.3 mm.; 6 whorls. Cruce, Moldavia.
Length 2.15, diam. 1.25 mm.; 6 whorls. Dalaroe, Sweden.

Europe generally; the Caucasus region and Turkestan; main island of Japan. America, from Alaska to Oregon, east in the northern states to the Middle States, New England, and Labrador.

Pupa edentula DRAPARNAUD, Hist. Nat. Moll. terr. fluv. France, 1805, p. 59, pl. 3, f. 28, 29.—PFR., Monogr. Hel. Viv., ii, p. 305; iii, 531; iv, 662; vi, 300; viii, 361 (see for older references).—KUESTER, Conchyl. Cab., *Pupa*, p. 116, pl. 15, f. 19, 20. — WESTERLUND, Fauna, p. 125. — *Pupa (Columella) edentula* KOBELT, Iconographie (2), viii, p. 96, pl. 236, f. 1542-3.—*Isthmia edentula* Drap., LOCARD, Catal. Génér. Moll. Viv. France, 1882, p. 177.—*Sphyradium edentulum* BOETTGER, Bericht Senck. Nat. Ges., 1889, p. 25 (Caucasus).—KENNARD and WOODWARD, Proc. Malac. Soc. Lond., iii, p. 190 (British Pliocene). — HIRASE, The Conchol. Mag., iii, pl. 9, f. 36 (Japan). — *Columella edentula* Drap., H. WATSON, Proc. Malac. Soc., xv, 1923, p. 275, fig. on p. 279 (anatomy).

Helix exigua STUDER in Coxe, Travels in Switzerland, iii, 1789, p. 386, a nude name, but said by Hartmann to be *P. edentula*.

Vertigo nitida FÉRUSSAC, Tabl. Syst., 1821, p. 64, new name for *Pupa edentula* Drap.

? Turbo offtonensis SHEPPARD, Linnean Trans., xiv, 1823, p. 155.

Alæa nitida JEFFREYS, Trans. Linn. Soc. London, xvi, pp. 358, 515.

Alæa revoluta JEFFREYS, Trans. Linn. Soc. London, xvi, 1830, pp. 359, 515.

Vertigo lepidula HELD, Isis, 1837, p. 307 ("*V. edentula* Pfr. not Drap.").

The shape, tapering above the penult or the last whorl, distinguishes this widely-spread species from *C. columella*. The first three measurements given above represent the usual size; Draparnaud's type, according to the size-figure, was 2.5 mm. Smaller ones, as in the fourth measurement, are rare in the European series before me.

In Europe, *Columella edentula* is generally distributed south to the Mediterranean, while *C. columella* is Alpine and boreal. America was colonized from the stock of the cool north, and *C. edentula* does not appear to have become adapted to warm southern states.

The Japanese specimens do not appear to differ from the typical European form. The localities are: Akkashi, Kushiro; Hakusan, Kaga; Kiyotaki, Omi, all collected by Y. Hirase. At present this area is widely separated from other recorded localities.

Dall has reported *edentula* from Petropavlovsk, Kamchatka; but as he did not consider the allied *C. columella,* the exact form found there remains uncertain.

According to Clessin (Malak. Bl., n. F., v, 1882, p. 6), *C. edentula* lives in damp places, near springs or damp, shady woods. In rainy weather they ascend smooth-barked trees, but few old shells are to be found. In late winter (February) he found them abundant on fresh shoots of *Spiræa filipendula,* still an inch below the dead-leaf covered earth. It lives in rather than upon the soil. Hugh L. Orr (in the Irish Naturalist, xi, 1902, 173) found *C. edentula* in June on furze bushes, which he was beating for beetles. Charles Oldham (Journ. of Conch., viii, 1895, p. 190) records finding great numbers on the broad leaves of *Tussilago petasites,* often 2½ to 3 feet from the ground, growing in a damp spot in a wood in Cheshire. Jeffreys, in British Conchology, i, p. 269, reports it from among dead leaves, on the trunks of trees and fronds of ferns. Von Martens (Sb. Ges. Nat. Fr. Berl., 1903, 399) found it in abundance sticking on the undersides of leaves of young maples.

Columella edentula turritella (West.). Pl. 30, fig. 8. Shell conic, tapering from the base, the whorls from the first to the fifth slowly increasing, none of them equal. Sweden; Bavaria (*Westerlund*).

Pupa inornata var., CLESSIN, Malak. Bl., xx, 1873, p. 55, pl. 4, f. 10 (Isar debris at Munich).—*Pupa inornata* Mich. var. *turritella* WESTERLUND, Malak. Bl., xxii, 1875, pp. 127, 131.—*Edentulina edentula* var. *turritella* West., CLESSIN, Moll. Oesterreich-Ungarns, 1887, p. 262, fig. 161 (Switzerland and the Tyrol). — *Pupa edentula* Drap. var. "*turricula* Cless.," BOETTGER, Jahrb. D. M. Ges., vi, 1879, p. 415 (Reichenhall, very abundant).

Columella edentula nana (Boettger). Pl. 30, fig. 5. Smaller and narrower, 2.4 mm. high, 1.2 wide, with 6 whorls. Caucasus: Kasbek (*Bttg.*).

Pupa (Columella) edentula Drap., f. *nana* BOETTGER, Jahrb. D. M. Ges., vii, 1880, p. 139, pl. 4, f. 9.

4. Columella columella (Benz). Pl. 31, figs. 1, 2, 3.

Shell small with a very narrow but distinct umbilical perforation, almost completely cylindric, quite blunt, of 8 very slowly increasing and strongly convex whorls, therefore separated by a deep suture; last whorl is more ventricose than the rest, and somewhat larger in circumference. Aperture is semi-ovate, toothless; peristome straight, simple and sharp. Length 1⅓ lines, diam. ½ line; 8 whorls (*Rossmaessler*).

Switzerland, the Tyrol and the Tatra range (Shuttleworth, Gredler and others). Sweden: Quickjock, Lulea Lappland; Bollnas, prov. Helsingford. Norway: Storvik in Waage (Westerlund). Petrograd. Siberia in the Government Jenisejsk, 61° to 70° 5′, and in the Amur valley. Alaska at Port Clarence (Vega Exp.). Pleistocene of Hungary, Germany, the Rhone valley and England. Type loc., diluvial near Stuttgart, between Heslach and Kaltental.

Pupa columella Benz, Verzeichniss der im Koenigreich Würtemburg gefundenen Schalthiere, in Corresp. Bl. Würt. Landeswirth. Verein, XVII, 1830, p. 49 (not seen by H. P.). Rossmaessler, Iconographie, II, pt. xi, 1842, p. 11, pl. 53, f. 731. — Kuester, Conchyl. Cab., *Pupa*, p. 19, pl. 3, f. 4, 5.—Pfeiffer, Monogr. Viv., III, 531.—Wallenberg, Malak. Bl., 1858, p. 102, pl. 1, f. 6, 7 (Lappland).—Clessin, Malak. Bl., XX, p. 56, pl. 4, f. 9.—Westerlund, Exposé Crit., Nova Acta Reg. Soc. Upsaliensis, (3), VIII, 1873, p. 87; Vega-Expeditionens Vetenskaplige Iakttagelser, IV, 1887, pp. 155, 159, 163 (Siberia, Alaska).—*Pupa (Alæa) columella* G. von Martens, Sandberger, Land- und Süsswasser-Conch. Vorwelt, p. 795, pl. 33, f. 34; pl. 36, f. 27. — *Sphyradium columella* Geyer, Nachrbl. D. M. Ges., vol. 44, 1912, pp. 122-125. — *Columella columella* (Benz), Kennard, Proc. Malac. Soc. Lond., XVI, 1924, p. 93 (Boreal stage of English Pleistocene).

Pupa inornata Mich., Kuester, Conchyl. Cab., *Pupa*, p. 115, pl. 15, f. 17, 18 (in one of the highest woods of the northern spur of the Gemmi, on rotten wood).

Pupa gredleri Clessin, Malak. Bl., XX, 1872, p. 57, pl. 4, f. 8.—*Edentulina gredleri* Clessin, Moll. Oesterreich-Ungarns u. Schweiz, 1887, p. 263, f. 162.—*Pupa (Columella) gredleri* Kobelt, Iconographie, (2), VIII, p. 97, pl. 336, f. 1544. Cf. Gredler, Nachrbl. D. M. Ges., XI, 1879, p. 5.

In this species the first three whorls form a very obtuse, convexly conic summit, the next two to three are equal in diameter, and the last is expanded. The surface is like that of typical *C. edentula,* being marked with very slight, irregular growth lines. The initial whorl is white, the rest pale tawny in the loess specimens seen. One from Munich measures: length 2.75, diam. at last whorl 1.3 mm.; 6¾ whorls (fig. 1).

Benz appears to have had the name of this snail from Georg von Martens, who is quoted as authority for it by some authors.

Widely spread in the Pleistocene, this species is now rare and discontinuous in distribution, being found in the eastern Alps and the far north. The recent form described as *Pupa gredleri,* does not appear to differ tangibly from the loess fossil. Clessin's account follows:

Pupa gredleri Clessin (pl. 30, fig. 3). Shell cylindric, with very short, obtuse summit, consisting of 7 to 7½ rather convex whorls, the first two increasing very rapidly and forming the short summit, the 3d, 4th and 5th almost wholly equal in height and breadth, the last considerably higher and wider; umbilicus very narrow. Shell in diameter somewhat narrower, very finely striate, slightly glossy, distinctly translucent, of a reddish-brown color. Aperture nearly rounded, lunate; peristome blunt, scarcely expanded. Length 2.5, diam. 1 mm.

In the upper forest and alpine region, in Switzerland (Gemmi), in Tyrol, Campen near Bozen, Alpe Perdoi, on the Schlern, on the Tristenstein, in the Tauferstal, on the Peitler Kofel and the Franzenshöhe.

This species stands nearest to the diluvial *P. columella* Benz, which agrees with it generally in form; it differs from that by the smaller diameter and the somewhat smaller size. It differs from *edentula* by the more slender form, greater length and the considerably predominating last whorl.

5. Columella inornata (Michaud). Pl. 30, fig. 4.

The shell is long, cylindric, very delicately striate, pellucid, umbilicate, fulvous; whorls 8, convex; suture rather deep; aperture semilunar, toothless; peristome subreflected; apex obtuse. Length 2 lines, diam. ¾ line.

This species is larger than *P. muscorum* Drap., which it quite resembles in appearance. It is not to be confused with *Pupa edentula* of the same author; it is far more lengthened and more cylindric (*Michaud*).

Length 4, diam. 1.5 mm.

France: alluvium of the Rhone, Lyons (Michaud).

Pupa inornata MICHAUD, Complément Hist. Nat. Moll. terr. fluv. France de Drap., 1831, p. 63, pl. 15, f. 31, 32; *cf.* BOETTGER, Jahrb. D. M. Ges., VII, 1880, p. 140.—DUPUY, Hist. Nat. Moll. France, p. 423, pl. 20, f. 18.—WESTERLUND, Fauna, p. 125.—*Pupa (Columella) inornata* KOBELT, Iconographie (2), VIII, p. 97, pl. 336, f. 1545.—*Pupa columella* LOCARD, Arch. Mus. Hist. Nat. Lyon, II, 1878, p. 231.

The large size of this species—up to 4.5 mm. long, distinguishes it from the widely-spread *C. columella;* moreover, the shape is strictly cylindric, the last whorl not noticeably dilated. Only dead specimens have been found, but whether Pleistocene or later has not been made clear. Not seen by me.

6. COLUMELLA GUTTA (Benson). Pl. 31, fig. 5.

Shell obsoletely rimate, oblong-ovate, smooth, thin, pale corneous, translucent; spire obtusely ovate; suture impressed; 4½ slightly convex whorls, the last descending in front. Aperture oblique, toothless, angulate-rounded; margins of the peristome remote, the right margin unexpanded, acute, the columellar a little expanded. Length 1⅔, diam. 1 mm. (*Bens.*).

India: Spiti Valley, Kunawur (W. Theobald), a single specimen.

Pupa gutta BENSON, Ann. Mag. N. H. (3), XIII, Feb. 1864, p. 138.—HANLEY and THEOBALD, Conchologia Indica, pt. 6, pl. 101, f. 9.—PFEIFFER, Monogr., VI, p. 298.—*Pupilla gutta* Bens., GUDE, Fauna Brit. India, Moll., II, 1914, p. 285.

A lost species, from a high, doubtless Palæarctic station. It appears to differ from *C. edentula* by the smaller size and pale color, but if an adult shell, probably belonging to *Columella.* The figure is a photograph of that in Conchologia Indica.

3. *American species.*

7. **Columella edentula** (Drap.). Pl. 30, figs. 12 to 17.

Description on page 236. In some localities, such as Oswego, Clackamas Co., Oregon, and the Magdalen Islands, Gulf of St. Lawrence, the specimens resemble the typical European *edentula* closely. Two from Oswego, Ore., measure:

Length 2.2, diam. 1.35 mm., 6½ whorls.
Length 2, diam. 1.3 mm., 5½ whorls.

Generally in America the size, especially the diameter, is noticeably smaller than in the typical form of Europe; and there is some reason for segregating the prevalent form in the eastern states as a local race, *simplex* Gld.

Length 2.15, diam. 1.1 mm., 5¾ whorls. Oxford Co., Maine.
Length 2.1, diam. 1.15 mm., 6¼ whorls. Clementon, N. J.
Length 1.85, diam. 1.15 mm., 5½ whorls. Beaver Co., Pa.
Length 1.8, diam. 1.1 mm., 5½ whorls. Conecuh Co., Ala.

Most of the specimens in almost any lot collected are immature. In some places the full size seems to be rarely if ever attained. Gould's type of *simplex,* measuring $\frac{1}{15}$ inch long, $\frac{1}{30}$ wide, was either immature or from such a dwarf colony. The surface is nearly smooth, showing irregular and very low growth-wrinkles under the microscope.

This *simplex* form (pl. 30, figs. 15, 16, 17) is about the size of the Caucasian *C. e. nana* Bttg., which from the description and figure would hardly be distinguishable from the American form.

The small *simplex* form of the species I have seen from the states of Maine, Massachusetts, Rhode Island, New York, New Jersey, Pennsylvania, Wisconsin, Minnesota, Alabama and eastern Canada.

A few lots appear variable or intermediate between the large and small races.

In a few places there is a larger form (pl. 30, fig. 14) which agrees with the account of *C. e.* var. *turitella* West. in shape, but it has a distinctly striate surface. As the specimens are from several rather widely separated places with diverse faunal associations, I do not give them a special name.

Length 2.4, diam. 1.3 mm., 6⅓ whorls. Onondaga Co., N. Y., fig. 14.

Length 2.3, diam. 1.3 mm., 6½ whorls. Ward, Montana.

In Canada *C. edentula* occurs from the Magdalen Islands to Vancouver Island, and north (according to Dall) to Labrador, Alaska and some of the Aleutian Islands. Southward it is commonly found as far as New Jersey, Pennsylvania, Iowa, Montana and Oregon. I have seen a single very small specimen from Evergreen, Conecuh Co., Alabama (H. H. Smith), the only locality known in the Southern States (fig. 17).

American references.—*Pupa simplex* GOULD, Boston Journal of Nat. Hist., III, 1840, p. 403, pl. 3, f. 21 (grove north of Fresh Pond, Cambridge, Mass.); Terr. Moll., II, p. 343, pl. 72, f. 3.—*Vertigo simplex* Gld., W. G. BINNEY, Terr. Moll., V, 1878, p. 219; Man. Amer. Land Shells, 1885, p. 191, f. 195.—RANDOLPH, Nautilus, IX, p. 102 (Seattle, Wash.).—TAYLOR, Nautilus, V, p. 91 (Vancouver I.).—*Sphyradium edentulum* HANHAM, Nautilus, XI, p. 110 (Quebec).—STERKI, Nautilus, X, p. 75 (systematic position).—J. HENDERSON, Moll. of Colo., Univ. of Colo. Studies, IV, p. 177 (Colorado records, probably all *C. alticola*).—DALL, Harriman Alaska Exped., XIII, p. 54 (northern localities; includes *C. alticola* as a synonym).—HANNA, Proc. U. S. Nat. Mus., vol. 41, 1911, p. 374, f. 2, 3, 4 (anatomy).

8. COLUMELLA ALTICOLA (Ing.). Pl. 31, figs. 6, 7, 8.

Shell perforate, straight, two and one-half times as long as broad, densely striate, subtranslucent, chestnut-brown, apex obtuse; whorls 6 or 7, convex, the middle three of the spire equal, causing a parallelism in the sides of the shell, the last noticeably greater, expanding toward the aperture, not closely appressed to the body-whorl; suture deeply impressed; aperture small, oblique, subtriangular, margins connected by a thin deposit, without internal processes; peristome simple, somewhat reflected over the umbilicus (*Ingersoll*).

Length 3, diam. 1.35 mm.; 7½ whorls. Nat'l Park, Wyoming. Fig. 6.

Length 2.8, diam. 1.3 mm.; 7 whorls. Howardsville, Colo. Fig. 7.

Length 2.5, diam. 1.3 mm.; 6⅓ whorls. Banff, Alberta. Fig. 8.

New Mexico: Willow creek, Mogollon Mts. (Ferriss & Daniels); La Belle (Ashmun). Arizona: Millers Park, Huachuca Mts. (Ferriss). Colorado: Cunningham Gulch (type loc.) and Rio La Plata, 8-9000 ft.; Howardville (Ingersoll); Estes Park (Ashmun); near Colorado Springs (H. B. Baker); Tolland, Gilpin Co., 8900-9000 ft. (Cockerell); Florissant, Magnolia and Eldora (J. Henderson); Floyd Hill (Hand); near Ohio City (F. Rohwer); Long's Peak Inn (Spangler). Utah: Chalk Creek, 7500-8000 ft. (R. V. Chamberlain). Wyoming: Mammoth Hot Spring, Nat. Park (Elliott). Alberta: Banff (S. Brown); Kananaskis (J. Macoun). British Columbia: Field (S. Brown); Tobacco Plains, Kootenay River valley (J. B. Tyrrell). *Pleistocene,* Kansas: Long Island, Phillips Co. (Hanna).

Pupilla alticola INGERSOLL, Bull. U. S. Geol. and Geogr. Survey of the Territories, I, 2d ser., no. 1, 1875, p. 128; 8th Ann. Rep. Hayden Survey, 1876, p. 391, text-fig.—*Pupa alticola* W. G. BINNEY, Terr. Moll., V, p. 212, f. 116; Man. Amer. Land Shells, 1885, p. 174, f. 166.—CKLL., Journ. of Conch., VI, p. 62.—*Sphyradium alticola* HANNA, Proc. U. S. Nat. Mus., vol. 41, 1911, p. 373, text-fig. 2.—J. HENDERSON, Univ. of Colo. Studies, IX, 1912, p. 61.—*Columella alticola* (Ing.), BERRY, Canada Dept. of Mines, Bull. 36, 1922, p. 14.

Sphyradium edentulum J. HENDERSON, in part, Univ. of Colo. Studies, IV, p. 177.—WHITEAVES, Ottawa Nat., 1905, p. 171.—*S. edentulum* var. *alticola* COCKERELL, Nautilus, XXV, p. 58 (Tolland).

This species is more cylindric than *C. edentula,* the summit rounded, and when fully developed the last whorl is more swollen than those preceding. It reaches a larger size, and has more whorls. It is cinnamon-brown, like *C. edentula,* sometimes with some whitish streaks. The surface is finely striate, decidedly more so than in typical *edentula,* but not more than in the striate form of that species. All of the whorls are rather strongly convex. Young or small individuals may be recognized by the more cylindric shape of the spire and the striation, but occasionally their discrimination is difficult. Some of the Colorado records given above may possibly pertain to *C. edentula.*

Whether *C. alticola* is really distinguishable from *C. columella* appears to me doubtful, but the whorls are noticeably more convex and the striation a trifle more distinct than in the German loess *columella* compared. Larger series of *columella,* including recent specimens, are requisite for a definite decision. The form from Port Clarence, Alaska, referred to *columella* by Westerlund, is unknown to me. Hanna has suggested that some Unalaskan Columellæ belong to a new species with the following measurements: Length 2.84, diam. 1.6 mm.

9. Columella hasta (Hanna). Pl. 30, fig. 18.

Shell more than 5 mm. in height, long and cylindrical. Light brown in color and glossy. Spire greatly elevated but obtusely pointed on the apex. Whorls 8½ to 9, rather flattened on the face and the last subangulated around the periphery. The last six whorls are of about equal diameter; the first three increase rapidly. Lines of growth faint and oblique; apex smooth and white. Aperture somewhat angulated at the base of the columella. Peristome thin and acute, forming a regular curve without an indentation in the upper palatal region such as is present in most of the *Vertigos.* The aperture is very slightly thickened with callus on the inside of the peristome in the basal region. Peristome not reflected and with no callus crest back of the aperture. Teeth and lamellæ entirely absent from the aperture. Umbilicus with a very small perforation.

Length, 5.81 mm.; diameter, 2.03 mm. (*Hanna*).

Kansas: Pleistocene of Long Island, Phillips County (G. D. Hanna, Edw. C. Johnston).

Sphyradium hasta Hanna, Proc. U. S. Nat. Mus., vol. 41, Oct. 14, 1911, p. 372, text-fig. 1.

"This species differs from all others by its much greater size and the relatively smaller aperture." The specimens "occur in deposits of sandy, green marl of undoubted Pleistocene age. With them were large numbers of other Pupillidæ, as well as other land snails. The entire fauna of the beds is foreign to the region at the present time, but is allied to the present-day Canadian fauna. From this it is supposed that the animals lived just before or during the Glacial epoch."

Probably related to *C. inornata.*

10. Columella polvonensis (Pils.). Pl. 31, fig. 9.

The shell is narrowly umbilicate; oblong-ovate; opaque light buff with cinnamon streaks, the darker color predominating on the last whorl; rather glossy, smooth save for very weak growth-wrinkles. The spire tapers with convex outlines to the obtuse apex. Whorls moderately convex, the last very little more ample than the penult. Aperture truncate-rounded; peristome simple and sharp, the columellar margin broadly reflected.

Length 2.5, diam. 1.5 mm.; 6 whorls.

Nicaragua: Polvon, Department of Chinandega (McNeil Exped.).

Pupa polvonensis Pilsbry, Proc. A. N. S. Phila. 1894, pp. 31, 61, pl. 1, f. 11.—*Sphyradium polvonense* Pilsbry, Proc. A. N. S. Phila. 1903, p. 769.

The whorls are less convex than in *C. edentula,* and the umbilicus is larger. The whitish color is not present in young specimens. The dimensions were not given exactly in my former descriptions.

11. Columella(?) lata (C. B. Ad.).

Shell very short, subcylindrical, truncated anteriorly; pale brown or horn color; with very regular, rather distant, microscopic transverse lines, which are more distinct on the upper whorls; spire cylindrical; apex conoid; whorls five, very convex, with a deep suture; last whorl making nearly a right angle between its lateral and anterior surfaces. Aperture about two-thirds of a circle, without teeth; lip not reflected, with a smooth blunt margin; without umbilicus.

Length .075 inch; breadth .055 inch [about 1.9 x 1.4 mm.] (*C. B. Ad.*).

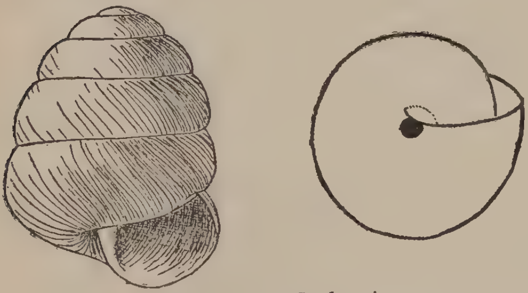
Jamaica (C. B. Adams).

Pupa lata C. B. Adams, Contrib. to Conchology, No. 3, 1849, p. 37.—? Pfeiffer, Monographia, III, p. 530.

4. *Hawaiian species.*

12. Columella sharpi (Pils. & Cooke). Pl. 30, fig. 6; text-figs. 14, 15.

The shell is narrowly umbilicate, broadly ovate, the summit obtusely conic; thin; chestnut brown, paler near the apex, the surface somewhat shining and distinctly but not closely striate. Whorls slightly over 5, quite convex, the suture deeply impressed. The aperture is strongly oblique, rounded lunate. Peristome thin and simple, the basal and outer margins well arched; columella vertical with broadly dilated edge. The insertions of the lips are remote. The umbilicus is circular and deep. Length 1.8, diam. 1.36 mm.



Figs. 14, 15. *C. sharpi.*

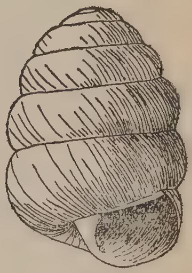


Fig. 16. *C. alexanderi.*

Hawaii: Crest of the Kilauea crater, about a half mile south of the hotel. Types No. 91699, A. N. S. Phila., collected by Dr. Benjamin Sharp; cotype in the Bernice Pauahi Bishop Museum, Honolulu. Also taken by Cooke and Pilsbry along the road to Kilauea iki, about ¾ mile from the Crater House.

Sphyradium sharpi Pilsbry and Cooke, Proc. A. N. S. Phila., July 23, 1906, p. 215, text-figs. 1, 2.

This species is closely related to the following two, from which it differs in being somewhat larger, broader, but with a smaller number of whorls and a less strongly striate surface. The shape also differs perceptibly, *C. alexanderi* and *C. olaaensis* being noticeably more egg-shaped, with a rounded summit.

13. Columella olaaensis new species. Pl. 30, fig. 7.

The shell is similar to *C. alexanderi* except that it is broader with a longer aperture.

Length 1.8, diam. 1.35 mm.; 5½ whorls. Type.

Length 1.9, diam. 1.35 mm.; 5¾ whorls. Paratype.

Hawaii: Olaa (Thaanum).

Two specimens were found in a topotypic lot of *Nesopupa wesleyana* (Anc.).

14. Columella alexanderi (Cooke & Pils.). Text-fig. 16.

The shell is openly perforate, dextral, ovate, the apex blunt; glossy, minutely irregularly striate, very thin, cinnamon-brown, the apical whorls much lighter; whorls 5½–5¾, well rounded, increasing very slowly; sutures simple, well impressed. The aperture is oblique, quadrate-lunate; columella vertical, lip thin, the outer margin simple, reflexed at the columella, margins remote; umbilicus circular, deep. Length 1.7, diam. 1.17 mm.

West Maui, at the top of Mt. Kukui, overlooking Iao valley, elevation about 6,000 feet. Found at base of leaves of low shrubs, two or three feet in height (C. Montague Cooke). Type in Bishop Mus., cotype No. 91,292 ANSP.

Sphyradium alexanderi Cooke and Pilsbry, Proc. A. N. S. Phila., July 23, 1906, p. 216, text-fig. 3.

Subfamily Pupillinæ.

PUPOIDES Pfr. Vol. XXVI, p. 108.

Pupoides pilsbryi Dall. Pl. 31, fig. 13.

The original figure of this species, referred to at the foot of p. 109, Vol. XXVI, appears to be incorrect in the teeth shown. A specimen kindly sent by Dr. Dall shows a strongly developed, rounded, nodular, angular lamella, much as in Asiatic *Pupoides*, being more developed than in Recent American species. The prominence within the outer lip defining the sinulus is more strongly developed than in Recent species, though some approach to it has been figured in Vol. XXVI, pl. 12, fig. 5, and others. The parietal and columellar teeth shown in the original figure appear to have been adhering siliceous material; or at least, I find no definite traces of them in the specimen examined.

The species seems thus to be a true *Pupoides,* somewhat more primitive than existing American species by the more distinct angular lamella.

Pupoides incolatus (White). *Pupa incolata* White, Powell's Rep. Geol. Uinta Mts., 1876, p. 130. *Pupa (Leucocheila) incolata* White, 12th Ann. Rep. U. S. Geol. and Geogr. Surv. Terr. for 1878, pt. 1, 1883, p. 47, pl. 19, f. 7*a-c.* Eocene, Upper Green River group: Valley of Henry's Fork south of Green River City, Wyoming.

Pupoides marginatus (Say). Vol. XXVI, p. 111.

Recorded by Hanna (Proc. Cal. Acad. Sci., 4th Ser., XII, no. 26, p. 514) from several islands in the Gulf of California: Angel de la Guarda, Tortuga, San Lorenzo, San Esteban, Montserrate. "The specimens cannot be distinguished from the species as it occurs in Arizona."

Pupoides catalinensis Hanna. Text-fig. 17.

Shell similar to *P. marginatus* but more slender and cylindrical; whorls five, rounded, suture deeply impressed; epidermis roughened parallel to growth lines, so the species is without gloss; growth lines fairly regular with an occasional white streak parallel to them; umbilicus rimate; peristome broadly reflected, thickened within and almost complete across the body whorl; no indentation of the aperture on the upper palatal wall (*Hanna*).

BC

Altitude 4.5, diameter 1.9 mm. Type.
Altitude 4.3, diameter 1.7 mm.
Altitude 4.0, diameter 1.5 mm.
Altitude 3.8, diameter 1.6 mm.

Santa Catalina Island, Gulf of California (J. C. Chamberlin, Cal. Acad. Exped.).

Pupoides catalinensis Hanna, Proc. California Acad. Sciences (4), XII, article 26, 1923, p. 514, pl. 10, figs. 1-4.

"This species has the shape of *P. hordaceus* (Gabb) but lacks the characteristic rib sculpture of that form. While the specimens of *Pupoides* from all of the other Gulf islands are clearly *marginatus* and agree with that species in size, shape and sculpture, this one on Santa Catalina Island is constantly different. There does not seem to be a tendency toward intergradation. There is some variation in altitude but the shape still remains more cylindrical than in *marginatus*" (*Hanna*).

Page 106. 13th line: for "Basal lamella" read Basal fold.

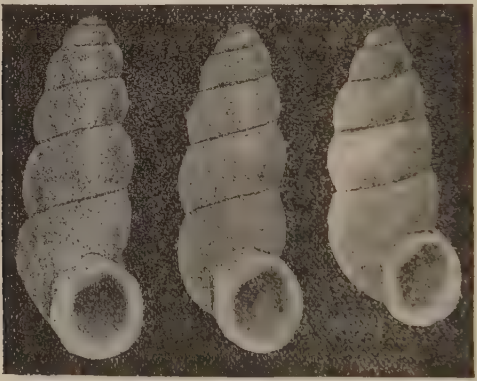


Fig. 17. *Pupoides catalinensis* (after Hanna).

Page 110. The last four species in the key form a special group of *Pupoides* which may be called section Ischnopupoides, *P. hordaceus* being the type. With Pupoides paredesii Orb. (XXVI, 120) I have united *Pupa limensis* Phil. The latter has been placed in the Diplommatinid genus *Adelopoma* by Doering, followed by Kobelt (Das Tierreich, Cyclophoridæ, p. 480), I think erroneously.

Page 112. 18th line from bottom: for "*shalls*" read *shells*.

Page 113. Pupoides marginatus nitidulus (Pfr.).

Aruba, Curaçao and Bonaire (H. B. Baker). The specimens are not distinguishable from those of Cuba, and there appear to be no differences between those of the three islands mentioned. It is variable in form and degree of development of the angular callus. Two from E. Oranjestad, Aruba, measure:

Length 3.6 mm., diam. 1.55 mm.
Length 3.6 mm., diam. 1.8 mm.

Probably *Leucochila simoni* Jousseaume from Caracas is identical with *P. m. nitidulus*. The description and figure show no differences (*Pilsbry,* Proc. A. N. S. Phila., 1924, p. 61).

No doubt it was this race which was formerly reported from Curaçao as typical *marginatus,* since the latter was not found by Dr. Baker in the course of a thorough search of the island.

Pupoides lardeus (Pfr.), Vol. XXVI, p. 126, has been reported from the Salt Range by Annandale and Rao, Rec. Ind. Mus., XXV, p. 393.

Pupoides zanguebaricus (Taylor). Pl. 31, figs. 10, 11.

Vol. XXVI, p. 134. This species has about the size of *P. senaariensis,* but it is distinguished by the absence of an angular nodule, though in some examples there is a slight thickening there.

Length 4.1, diam. above aperture 1.7, to edge of lip 1.9 mm.
Length 3.4 mm., smallest seen.

The figure is from a Zanzibar specimen from coll. Bryant Walker.

Pupoides bryantwalkeri new species. Pl. 31, fig. 12.

The shell is very slender, the diameter (measured above aperture) contained 3¼ times in the length. Summit obtuse; spire slowly tapering, the last two whorls of about equal diameter. The whorls are convex, the median ones more so than the earlier or last. Color cinnamon-buff. Surface not glossy, nearly smooth, but with some weak growth-ripples. The aperture is small, broadly ovate, the peristome white, expanded, somewhat thickened; outer lip regularly arcuate throughout, narrowed above. Parietal callus thin, bearing a large, noduliform angular lamella below the insertion of the outer lip and separated from it by a groove.

Length 4.55, diam. above aperture 1.4, to edge of outer lip 1.6 mm.; length of aperture 1.35 mm.; 6½ whorls.

South Africa: probably from the neighborhood of Port Elizabeth; collected by Crawford. Bryant Walker coll.

The very slender contour of this form apparently indicates specific distinction; otherwise it is closely related to the widespread *P. coenopictus*.

PUPOIDES MINUSCULUS (Mousson). Vol. XXVI, p. 139.

E. Degner has proposed *Leucochiloides minusculus* var. *major* (Beitr. zur Kenntnis Land- und Süsswasserfauna Deutsch Südwestafrikas, Mollusca, 1922, p. 31) for specimens with only 5 flatter whorls, regularly increasing in height, the suture shallower, last whorl $\frac{2}{5}$ to $\frac{2.1}{5}$ of the length. He gives localities: Tsumeb, Grootfontein, Otavifontain, Okaputa, Okahandja, Karibib, Osona. Whether they are referable to *calaharicus* or *minusculus* appears doubtful, as they form an intermediate phase.

P. calaharicus (Bttg.) is reported from Kuibis (p. 33).

Glyptopupoides new subgenus.

The shell is *Pupoides*-shaped, of few (about 4½) whorls, the embryonic 1½ minutely, densely pitted, the rest distantly ribbed and spirally striate. Peristome expanded, but little thickened; no angular tubercle or other teeth. Type *Pupoides hedleyi*.

PUPOIDES HEDLEYI new species. Pl. 31, fig. 15.

The shell is oblong with convexly tapering spire and obtuse summit; snuff-brown throughout; but slightly shining. First 1½ whorls are microscopically, very densely pitted, the rest sculptured with narrow, rather widely-spaced, retractive riblets, the intervals minutely and closely striate spirally, the striæ varying from distinct (as in the type) to quite weak in some other specimens. The whorls are rather convex, especially the penult. The aperture is ovate, somewhat oblique, without teeth or angular tubercle. Peristome is well expanded, colored like the shell, very little thickened within, the margins converging; columellar margin dilated. Parietal callus extremely thin.

Length 2.9, diam. above aperture 1.35 mm.; to edge of outer lip 1.5 mm.; 4½ whorls. Type, B. W. coll.

Length 3.1 mm. Paratype, ANSP. 134150.

Australia: Bundaberg, Queensland (Cox).

The type lot was from Cox in the Ponsonby collection, now in that of Bryant Walker, a paratype in ANSP. coll.

This species is quite unlike any known Australian snail by its sculpture and entire absence of teeth. It has some resemblance to the American group of *Pupoides hordaceus,* and also to the minute *Negulus suturalis.*

MICROSTELE Bttg.

Microstele noltei (Bttg.). Vol. XXVI, p. 150.

Reported from Omaruru by E. Degner (Beitr. zur Kenntnis Land- und Süsswasserfauna Deutsch-Südwestafrikas, 1922, p. 33, f. 11). The last whorl has a well-developed keel at the base, sharper than in Boettger's type.

Genus PUPILLA Leach (Vol. XXVI, p. 152).

The distribution and characters of German species of Pupilla have been lucidly discussed by D. Geyer in Nachrbl. D. Malak. Ges., vol. 42, 1910, pp. 12-18. The distinction of *P. bigranata* Rossm. from all forms of *muscorum* is upheld, and that species is said to occur in England, Iceland, Spain, France, Switzerland, Italy, loess of South Russia and in Turkestan.

Two keys are given for the discrimination of German species, as follows:

I. Larger forms, length 3 to 3.5, diam. 2 mm.
    1. Whorls wide, weakly convex, suture deep: *muscorum.*
    2. Whorls narrow, roundly convex, suture deep: *sterri.*
II. Smaller forms, length 2 to 2.5, width 1 to 1.5 mm.
    1. Whorls weakly convex, suture shallow: *bigranata.*
    2. Whorls strongly convex, suture deep: *triplicata.*

I. Shell ovate-cylindric.
  1. Strong-shelled, but little striate, with a somewhat oily gleam, larger: *muscorum.*
  2. Thin, pretty smooth, without luster, smaller: *bigranata.*

II. Shell regularly cylindric with blunt summit, finely, regularly and distinctly striate, with silky luster.
  1. Larger, with at most 2 teeth: *sterri.*
  2. Smaller, with three white teeth, that in the palate shining through distinctly: *triplicata.*

Section *Gibbulinopsis* Germain.

Gibbulinopsis GERMAIN, Bull. Muséum Hist. Nat. Paris, XXV, 1919, p. 265, as a subgenus of *Orthogibbus*, for *Pupa pupula, uvula* and *turgidula* of Deshayes. — Faune Malacol. terr. et fluv. des iles Mascareignes (Miss. zool. de M. Paul Carie), March, 1921, p. 23, *Orthogibbus (Gibbulinopsis) pupulus* Deshayes, of the Island of Reunion, named as type.
Primipupilla PILSBRY, Man. of Conch., XXVI, p. 153, August 4, 1921.

Gibbulinopsis was proposed as a subgenus of *Orthogibbus* (which was a new name for *Gibbulina* of authors, not Beck, with the type *O. modiolus* Fér.), and placed in the family "Enneidæ." In 1921 Germain selected *Pupa pupula* Deshayes as the type, thereby unconsciously removing *Gibbulinopsis* to Pupillidæ.

Primipupilla Pilsbry now becomes a synonym of *Gibbulinopsis.* It was proposed before Germain's publication of 1921 was received, and while I supposed that *Gibbulinopsis* would be retained for the Streptaxid species of Germain's group, not for the single *Pupilla* contained therein.

The following are to be added to the list of Tertiary *Pupillæ* in Vol. XXVI, p. 223:

PUPILLA ANODON (Desh.), which was placed with doubt in Vertigo (Vol. XXV, p. 218), is considered a Pupilla by Wenz (Foss. Catal., III, p. 952).

PUPILLA CROSSEI (Michaud) (Vol. XXV, p. 220, as *Vertigo*) is placed in *Pupilla* by Wenz.

? PUPILLA PARVULA (Desh.) (Vol. XXV, p. 218, as *Vertigo*) is placed in *Pupilla*, with a mark of doubt, by Wenz.

PUPILLA SCAPULA (Sandberger). *Pupa scapula* Sandb., Die Land- und Süsswasser-Conchyl. der Vorwelt, 1875, p. 703. Lower Pliocene, Pontien: Congeria beds, locality not given.

Vol. XXVI, page 224: *Pupilla m. lommickii* is a typographical error for *Pupilla m. lomnickii*.

PUPILLA MUSCORUM (L.). Vol. XXVI, pp. 156, 173.

Page 158, 8th line: In place of "Three-tooth mutations" read Four tooth-mutations.

Var. *prolongata* Baudon. Elongate, cylindric, and reaching a length nearly double that of var. *brevis* [which was not stated]. Banks of the Thérain at Mouy (Oise). (*Pupa muscorum* var. *prolongata* Baudon, Journ. de Conchyl., 1884, p. 260.)

Pages 185-6. PUPILLA CUPA. Boettger Nachrbl. 1884, p. 48) has given the synonymy of this species.

Page 188. The first two paragraphs should follow the account of *P. cupa turcmenia;* they were accidentally transposed.

Page 238. Last line, for "Russo" read Rosso.

PUPILLA FONTANA (Krauss.). Vol. XXVI, p. 207.

Connolly writes as follows (Ann. Mag. N. H., Ser. 9, X, p. 497, Nov. 1922):

> "*Ennea iredalei* [Preston, Revue Zoologique Africaine, i, 1911, p. 218, pl. 11, f. 5, from Naivasha, British East Africa. Length 2.75, diam. 1.25 mm.], of which I have examined paratypes, appears to have been founded on a large bleached example of *P. fontana*. It represents almost the largest form of the latter, and may be attributable to one of the so-called "species" evolved therefrom by Bourguignat; however, nearly every variation of size and dentition may be met with together in some parts of South Africa, and I agree with Pilsbry (Manual, 1921) in placing all the North and South African forms of the *fontana* group under one name. A smaller example of this species was collected by Percival between the Laikipia Plateau and Eusso Nyiro."

PUPILLA FONTANA form *elizabethensis*. Vol. XXVI, p. 213. The reference should be added: *Pupa elizabethensis* MELV. & PONS., Ann. Mag. N. H., (6), IX, Jan. 1892, p. 91, pl. 5, f. 13.

Subfamily ORCULINÆ.

ORCULA Held. This volume, p. 1.

ORCULA DOLIOLUM (Brug.). Vol. XXVII, p. 17.

Var. *breviuscula* Baudon. Shell very short, thick-set, with the same number of whorls as the type; of a light reddish color. Ongy, Ansacq. Houdainville (Dép. l'Oise, France). In woods; covers the shell with earth. (*Pupa doliolum* var. *breviuscula* [Var. brevis, Nouv. Cat. Moll. Oise], Baudon, Journ. de Conchyl., 1884, p. 259.)

Notes on *O. doliolum*, *O. orientalis* and *O. raymondi* from drift debris of the Sarus at Adana, Cilicia, were given by Boettger, Nachrbl. D. M. Ges., 1905, pp. 106-108. The three specimens of *O. doliolum* taken are sinistral. The name var. *heterostropha* is proposed for them.

ORCULA BULGARICA Hesse. Pl. 21, fig. 11.

Vol. XXVII, p. 26. Figured from a cotype kindly lent by Hesse.

ORCULA TINGITANA Pallary.

Shell elongate, truncate-conic in the middle, with spheric summit, the lower part narrower than the upper. Summit smooth, very obtuse. Whorls convex, separated by an impressed suture and engraved with oblique, fine striæ directed from left to right. Last whorl narrower than the others. Outer margin of the aperture vertical, forming a convex arc in the middle. Aperture oval, with an oblique lamella on the parietal wall. Columellar margin straight towards the insertion, then strongly curved in the lower part. Umbilical crevice quite apparent. Length 7.5, diam. 3 mm. (*Pallary*).

Morocco: margin of the oued Ouerrha (Lt. Burnot).

Orcula tingitana PALLARY, Bull. Soc. d'Hist. Nat. Afrique du Nord, ix, July 1918, p. 149.

ORCULA WAGNERI Sturany. Pl. 21, figs. 12, 13.

Shell rimate, long-cylindric with broad, conic, rounded summit, or ovate-conic; yellowish to reddish horn-colored; fresh specimens with fine, rather close epidermal rib-striæ, which give the shell a clear silky luster. The spire consists of 7½ to 8 whorls, at first weakly convex, later nearly flat, and separated by a shallow but distinctly impressed suture. The last whorl is rounded around the umbilicus, and it ascends a little and for a long distance to the aperture. The thin peristome is narrowly expanded, the columellar margin straight, the outer margin curved nearly in a half-circle, the insertions connected by a very thin callus. In the throat there is a callus, showing yellowish through the shell outside (similar to that of *Orcula gularis* Rssm., but weaker), which often thickens the middle of the outer margin to a weak tooth, though appearing never to be prolonged fold-like. The parietal lamella is high and curved outwardly. On the columella there are two weak folds, which usually end deep in the throat, rarely reaching the peristome.

Length 5.3 to 6.5, diam. 3 to 3.2 mm. (*Sturany*).

Albania: Mal i Sheit near Oroshi, Merdita; Mt. Munela and Mt. Zebia near Oroshi; on the Drin below the Koritnik mountains; and in the Ljuma region of the Koritnik mountains, 2000 meters (Buljubasic and Winneguth).

Orcula wagneri STURANY, Denkschr. Math.-Naturw. Kl. Kaiserlichen Akademie der Wissensch., Wien, Bd. 91, 1914, p. 63, pl. 15, f. 82*a-b*.

Orcula wagneri ljubetensis Sturany. Pl. 21, fig. 10.

The shell is larger with obsolete palatal callus and only one (the lower) columellar fold, which terminates deep within and is only visible in an oblique view in the mouth. Length 5.7, diam. 3.2 to 3.5 mm. Found at Ljubeten, Schar Dagh, northwest of Usküb by V. Apfelbeck and Gf. Attems, 1906 (*Sturany*).

Orcula wagneri ljubetenensis STURANY, tom. cit., p. 64, pl. 14, f. 81.

This new Orcula is distinguished from the nearly related

Orcula schmidti Kstr. by the smaller number of the more rapidly increasing whorls, which appear relatively much higher; by the palatal callus present in the typical form; the narrow, crevice-like umbilicus; the last whorl rising less in front, and rounded around the umbilicus, not compressed into an obtuse angle such as *O. schmidti* shows. It differs from *O. gularis* and its form *spoliata*, which are also similar, by the thicker, cylindric shell, its apex not tapering but rounded off, by the more distinctly convex whorls, separated by a deeper suture, the epidermal rib-striæ, wider peristome, as well as by the much weaker palatal callus (*Sturany*).

LAURIA Gray. (This volume, p. 43.)

LAURIA CYLINDRACEA DaC. Page 47.

By a careless oversight, the name was printed LAURIA CYLINDRICA on page 47.

Ernst Schermer-Lübeck has given the distribution of this species in Germany. In places about Kellersee and the Ratzeburgerseen he found a long form with weakly developed apertural features. In the same places the toothless form *inermis* Westerl. lives. In the region of these north German lakes *L. cylindracea* has almost become a real water animal, living among the dripping-wet beech leaves quite in the water (Archiv. f. Molluskenk. 1922, 171, 178).

Lauria cylindracea margieri (Caziot).

This is a short form, ball-like, with the peristome thick and white. It differs from the type by the rounded, ventricose form, the shortened spire and the absence of teeth in the aperture.

The form *curta* West. is toothed like the type. The form *inermis* of the same author is not also ventricose (*Caziot*).

Corsica: on dry stones of a wall on the railroad near Bastia; with *L. umbilicata.*

Lauria umbilicata var. *margieri* CAZIOT, Bull. Soc. Sci. Hist. et Nat. de Corse, Bastia, 1903, xxii, Ann., p. 278.

Lauria cylindracea misella (Paul.). This vol., page 53.

Add the reference *Pupa cylindracea* var. *misella* PAULUCCI, Bull. Soc. Mal. Ital., viii, 1882, p. 279, pl. 8, f. 2.

LAURIA UMBILICUS (Roth). This vol., page 54, 5th line from bottom: for "Syria" substitute Syra.

LAURIA ISSERICA (Letourneux).

Shell narrowly perforate, cylindric, fragile, subpellucid, nearly smooth, uniform corneous. Spire cylindric, slightly acuminate, rather long. Apex strong, paler, very obtuse. Whorls 7, somewhat convex, slowly increasing, separated by a little impressed suture, the last whorl a little larger, convex, rather swollen below. Aperture slightly oblique, slightly lunate, suboblong; columella straightened a little; peristome paler, straight, slightly expanded. Length 4, diam. 2 mm. (*Let.*).

Algeria: Tizi R'ir, above the gorge of the Isser, Kabylie (Letourneux).

Pupa isserica LETOURNEUX, Ann. de Malac., I 1870, p. 312; and in Hanotaux et Letourneux, La Kabylie, I, 1872, p. 226.

"Intermediate between the group of *P. umbilicata* and that of *P. inornata.*"

According to M. Margier (Feuille Jeunes Naturalistes, Année 40, p. 160) this is a *Lauria.*

LAURIA DADION (Bs.). Page 64.

"A single specimen, taken alive [on Mt. Manotsuri, Shilwane district, 4,000 feet], gives a remarkable extension to the limited range of this species. In *L. dadion*, as well as in its near allies *L. farquhari* and *L. tabularis* (M. & P.), there is frequently a slight, bluntly pointed swelling half-way up and rather deep-set on the columella, showing through the shell as a white line observable within the umbilicus; in Junod's shell this swelling is more prominent than in any other of twenty which I have examined from Cape Town and Karkloof, and seems to be represented by a clear furrow, rather than a white line, in the umbilicus; it will be interesting to see whether this variation is constant if further examples are ever collected in the same neighborhood" (M. Connolly, Proc. Malac. Soc. Lond., XV, Dec., 1922, p. 76).

Caucasian Lauriæ (this vol., p. 74).

The name of section *Caucasica* C. & M. proves to be preoccupied by *Caucasica* Bttg., 1877, in *Clausiliidæ.* As a substitute, *Caucasipupa* may be used for *Lauria caucasica,* which I designated type of *Caucasica* in 1922 (p. 67), with its immediate allies.

For the Series of *L. superstructa* (this vol., p. 74) may be used the sectional term *Euxinolauria* Lindholm (Proc. Malac. Soc. Lond., XVI, June 1924, p. 66, footnote), of which *Pupa pulchra* Ret. was designated type. The distinctions of these two groups are given on p. 68, in the section of the key numbered 4.

Subfamily Pagodulininæ.

PAGODULINA Clessin.

This Vol., page 176. *P. perplicata,* 11th line from bottom: the date should be *1889,* not 1899.

Genera and Species of Uncertain Affinities or not belonging to the Pupillidæ, or Undefined.

(Family Endodontidæ.)

Genus PHENACHAROPA Pilsbry.

Man. Conch., IX, p. 29.—Suter, Man. N. Z. Moll., 1913, p. 696, as a subgenus of *Endodonta.*

Animal having long peduncles and short tentacles; foot with a peripodial groove, and there is no mucous caudal pore present. Jaw arcuate, vertically striated. Radula with tricuspid central and lateral teeth, marginals tri- and quadricuspid.

Shell pupiform, cylindrical, the height about double the diameter; apex obtusely rounded; base slightly wider, convex, and narrowly perforated; surface ribbed and maculated as in the subgenus Charopa; aperture subvertical, higher than wide, toothless; peristome simple, thin, the columellar margin dilated (*Suter*).

Distribution: New Zealand.

Pupillidæ are lacking in the New Zealand fauna, but a *Charopa* has evolved a shell with the shape of *Pupilla* or *Columella*, retaining the original sculpture and coloration. Its true affinity was first recognized by Henry Suter. As no description of *Pupa novoseelandica* has appeared elsewhere in this Manual, it is given here.

PHENACHAROPA NOVOSEELANDICA (Pfeiffer). Pl. 29, fig. 10.

Shell perforate, subcylindric, thin, obliquely closely ribbed; deep brown, variegated with straw-colored spots, especially at the impressed suture; spire slightly tapering upward, the apex rather rounded. Whorls 7½, a little convex, the last less than one-third the length, rounded. Aperture subvertical, semicircular, toothless; peristome simple, unexpanded, the margins remote, columellar margin slightly dilated above. Length 4.75, diam. 2 mm., aperture 1⅓ mm. long. (*Pfr.*).

New Zealand, North Island: Gisborne, Waimarama, Napier, Dannevirke, Ormundville, Wellington, etc. South Island: Happy Valley, Stonyhurst (Suter).

Pupa novoseelandica PFEIFFER, in Kuester, Conchyl. Cab., *Pupa,* p. 135, pl. 17, f. 18, 19; Proc. Zool. Soc. London, 1852, p. 149; Monogr., III, p. 530.—*Endodonta (Phenacharopa) novoseelandica* SUTER, Man. N. Z. Moll., 1913, p. 697, pl. 27, f. 13.—*Pupa neozelanica* Pfr., HUTTON, Trans. N. Z. Inst., XVI, p. 191.

Pupina Ehrenberg, Symbolæ Physicæ 1831, was proposed as a subgenus of *Chilodonta,* for toothed Pupæ; no species mentioned. Name preoccupied in *Cyclophoridæ.*

Odostomia Fleming (Brewster's Edinburgh Encyclopædia, VII, p. 76, about 1813) was proposed for a heterogeneous group including some Pupillidæ, *Azeca, Carychium* and various marine shells. As B. B. Woodward has shown (Journ. of Conch., X, 1903, p. 359), Fleming later eliminated the land shells from his genus, which has been generally retained for a group of Pyramidellidæ with *Turbo plicatus* as type (see Dall and Bartsch, Bull. 68, U. S. Nat. Mus., 1909, p. 131).

Puppa Denys de Montfort, Conch. System., II, 1810, p. 298, monotype *Pupa uva,* becomes a synonym of *Cerion* Bolt., Vol. XIV, p. 174.

Deloplecta and *Hercodonta* Agassiz are mentioned with false references as subgenera of *Pupa* in Agassiz's Nomenclator Zoologicus. Nothing further is known of them.

Gibaulina J. Mabille, Bull. Soc. Philomathique (3), IX, 1896, p. 101, for *Pupa dealbata* W. & B., is evidently a typographical error for *Gibbulina*.

Dontostoma Hartmann, Systematisches Uebersicht der Europäischen Gattungen, in Erd u. Süsswasser Gasterop. Schweiz, 1840. Name only.

"*Cochlodon* Fer." Orbigny, Mag. de Zool., 1835, Cl. V, No. 61, p. 21, an emendation of *Cochlodonta* Fér., was used for various Pupillidæ, Bulimulidæ and Megaspiridæ.

Pupa maculosa Lamarck. T. cylindracea, attenuato-acuta, pallide cornea, apice rufa, maculis fulvis longitudinalibus sparsis picta; apertura (in fundo) quadridentata; labrum tenue, margine reflexo.—Long. 5¼ lignes. L'ile de Ténériffe (Lamarck, Anim. s. Vert., VI, pt. 2, 1822, p. 107).

Thought by Anton to be *Odontostomus inflatus* (Wagn.).

Jaminia sulculata Risso, Hist. Nat. Eur. Mérid., iv, 1826, p. 90, from Nice, has never been recognized and the type is broken, according to Caziot.

Jaminia trilamillata Risso, t. c., p. 91, Nice. Not identified by other authors. The type has been lost according to Bourguignat and Caziot.

Jaminia heptodonta Risso, t. c., p. 92. Unrecognized. Type lost.

Pupa labyrinthus, Mus. reg. Berol., Menke, Syn. Meth. Moll., 1828, p. 19; nude name.

Pupa pachygastra Menke, Syn. Meth. Moll. in Mus. Menkeano, 1828, p. 19 (based upon *Carychium menkeanum* Pfr. and *H. goodalli* Fér.; *Torquilla pachygastra* Zgl., quoted as a synonym) = *Azeca;* Man. Conch., XIX, 292.

Pupa hebraica (Tristram).

The shell is very minute, oblong, regularly and very beautifully striated with grooves; summit short and very obtuse;

glossy, corneous, pellucid. Whorls 6, the third more swollen than the last; suture deep; last whorl strongly contracted at the mouth. Aperture nearly round, but contracted below; peristome continuous, above with a single callus, slightly reflected; 3-toothed, one on the callus, two situated on the left margin. Length 2¾, diam. 1½ mm. (*Tristram*).

Palestine: in a tomb near Jericho.

Pupa hebraica TRISTRAM, Proc. Zool. Soc. Lond., 1865, p. 539.

"The beautiful and regular transverse ridges on the whorls, as seen through a magnifying glass, at once distinguish this from every other species of *Pupa*" (*Tristram*). Westerlund places this species in *Vertigo*, but he had not seen it.

PUPA BERMUDENSIS Temple Prince [misprint for Prime] Bermuda Pocket Almanack for the year of our Lord 1853, p. 55. Name only, and no further information has been published.

PUPA TERRICOLOR, *P. ceylanensis*, *P. solitaria*, *P. oleosa* Nevill, Enum. Helic. Ceylon, 1871, p. 6. Undescribed.

PUPA EKIOTE Chitty ms., Gloyne, Journ. de Conchyl., xiii, 1875, p. 121. Brownstown, Jamaica. Undescribed.

PUPA SIMPLEX Sandberger. Die Land und Süsswasser-Conchyl. der Vorwelt, 1872, p. 246, pl. 12, f. 15, 15*a*. Not *Pupa simplex* Gould, 1840.—*Gibbulinella simplex* (Sdbg.) Wenz, Fossilium Catalogus, Pt. 18, II, 1923, p. 734. Eocene, Bartonien: Ronca beds, Prov. Vicenza, Italy.

As the name of this species is preoccupied, it may be called GIBBULINELLA ERRO. It is considered to be congeneric with the living *Pupa dealbata* W. & B. of Teneriffe, which is known to belong to the Streptaxidæ.

PUPA MICROSTOMA Moellendorff, Jahrb. D. M. Ges., 1881, p. 311, not *Pupa microstoma* Pfeiffer, 1854, may be called GULELLA DUPLICARIA.

PUPA CONDITA Gassies, Journ. de Conchyl., xvii, 1869, p. 73, is a *Rissoa* in poor condition according to Crosse, Journ. de Conchyl., xlii, 1895.

PUPA ANODONTA Hedley and Musson, Proc. Linn. Soc. N. S. W. (2), VI, 1891, p. 558, belongs to the genus *Heterocyclus* Crosse.

PTYCHOSPIRA DELOPLECTA Slavik, pl. 32, figs. 14, 15 (Achiv. für naturw. Landesdurchforschung von Böhmen, i, 1869, Section II, p. 267, pl. 4, f. 14, 15) is a new genus and species based on a minute shell 2 mm. high, 1 wide, of 4½ whorls, described as finely rib-striate with transversely oval aperture, simple, sharp lip, the parietal wall bent in form of an entering fold, the sharp angle of which projects into the cavity of the whorl, the cavity between this parietal fold and the penult whorl is open towards the umbilicus; in front the fold is truncated and closed by a thin callus. The figures were restored from parts of three broken specimens, and may therefore be inaccurate. Marly beds of Tuchoric, Czechoslovakia. G. Klika agrees with Sandberger in considering this the immature stage of a Pupid shell (Tert. Land- u. Süsswasser-Conch. N.-W. Böhmen, 1891, in Archiv. naturw. Landesdurchforschung Böhmen, vii, Geol. Abth., p. 98), though it does not appear referable to any known Pupid of the same beds.

PUPA HELICOIDES Meek & Hayden, Proc. A. N. S. Phila., VIII, 1856, p. 118. Paleocene: 3 miles above Ft. Union, mouth of the Yellowstone, North Dakota.

PUPA MONTOLIVENSIS Noulet, Mém. Coq. foss., terr. d'eau douce du Sud-ouest France, 1854, p. 9. Montolieu, Conques. Dép. de l'Aude.

PUPA ISONAE Vidal, Mem. Real Acad. Cienc. y Artes de Barcelona, XVII, No. 2, p. 18. Cretaceous, Catalonia.

PUPA BULIMOIDEA Michaud, Actes Soc. Linn. Bordeaux, x, 1838, p. 153, fig. 1. Fossil, mountain of Reims.

PUPA GIBBOSA Michaud, Actes Soc. Linn. Bordeaux, x, 1838, p. 154, fig. 2. Fossil, mountain of Reims.

PUPA VECTIENSIS Edwards MS., R. B. Newton, Syst. List of the F. E. Edwards Collection of British Oligocene and Eocene Mollusca in the Brit. Mus., 1891, p. 273 (no description). Oligocene: Bembridge Beds, Sconce.

Pupa archiaci Boissy, Mém. Soc. Geol. France (2), III, 1848, p. 275, pl. 5, f. 21.—Deshayes, An. s. Vert. Bassin Paris, II, p. 850. Rilly.

Pupa bythiniformis K. Miller, Jahresh. Ver. Vaterl. naturk. Württemb., vol. 63, 1907, p. 455, pl. 9, f. 17. Eocene: Bachhagel, Bavaria.

Pupa amblymorpha Fontannes, Descr. sommaire Fauna malac. form. saumatres et d'eau douce du Groupe d'Aix, Bas-Languedoc, etc., p. 38, 1884. Lower Oligocene: Avéjan pres Barjac (Dép. Gard).

Pupa fabrei Fontannes, Descript. somm. fauna malac. etc., 1884, p. 38, pl. 4, f. 58, 59. Upper Oligocene, Chattien: Sigean (Aude), Montpezat and Montredon (Gard).

Pupa antiquitata Clessin, Bericht Naturw. Ver. Regensburg, XIII, 1910-11, p. 106 (1912). Upper Miocene: Undorf near Regensburg.

Vertigo corduensis Noulet, Bull. Soc. Hist. Nat. Toulouse, i, 1867, p. 153. Oligocene, Rupelien: Dép. Tarn.

Pupa elegans Matheron, Ann. Sci., Indust. du Midi France, III, 1834, p. 57, pl. 1, f. 11. Lower Eocene, Aix etc., Dép. Bouches-du-Rhone.

Pupa incolata White, Bull. U. S. Geol. and Geogr. Surv. Terr., III, 1877, p. 611; Ann. Rep. U. S. Geol. and Geogr. Surv. Terr. for 1878, p. 47, pl. 19, f. 7*a*-*c*. Paleocene, Green River Beds, Henry's Fork, Wyoming.

Pupa inversa Grateloup, Bull. Soc. Hist. Nat. Soc. Linn. Bordeaux, II, 1827, p. 97. Lower Miocene: Castelcrabe (Dép. Landes).

Pupa phrygica Oppenheim. Zeits. Deutsch. Geol. Ges., LXX, 1918, p. 182, pl. 12, f. 3 (1919). Neogen: Issis Han, Phrygia.

Pupa schweinfurthi Mayer-Eymar, Vierteljahrschr. naturf. Ges. Zürich, XXXIV, 1889, p. 204, pl. 1, f. 16. Lower Oligocene: Cairo.

PUPA TONGRIANA Mayer-Eymar, Vierteljahrschr. naturf. Ges. Zürich, vol. 34, 1889, p. 204, pl. 1, f. 17. Oligocene: Cairo.

PUPA SPRETA Noulet, Bull. Soc. Hist. Nat. Toulouse, I, 1876, p. 153. Oligocene: Dép. Tarn.

PUPA STRIATA Grateloup, Conchyl. foss. bassin de l'Adour, Actes Soc. Linn. Bordeaux, X, 1838, p. 116, pl. 4, f. 16.—*Pupa inversa* Grat., 1827, undescribed.—*Pupa substriata* Orb., Prodr. de Paléont. strat. univ. des Anim. moll. et rayon., III, 1852, p. 26. Lower Miocene: Dax, Faluns jaunes de Mainot à Castelcrabe (Dép. Landes).

PUPA SUBQUADRIDENS Orbigny, Prodr. de Paléont. strat., III, 1852, p. 26.—*Pupa quadridens antiqua* Grateloup, Actes Soc. Linn. Bordeaux, X, 1838, p. 116, pl. 4, f. 16; Conchyl. foss. Terrains tert. du Bassin de l'Adour, 1840, Atlas I, Pup. I, f. 18. Miocene: Dax, Faluns jaunes de Mandillot à Saint Paul. Probably a *Chondrula*.

PUPA MARIGNANENSIS Roule, Ann. de Malacologie, II, 1884-86, p. 213, pl. 2, f. 16. Upper Cretaceous: upper zone of the Lychnus stage, Rognac, Velaux, Marignane, etc., Provence. A rather obese species of the genus *Palæostoa*.

APPENDIX I.

THE ABIDAS AND CHONDRINAS OF THE PYRENEES AND THE IBERIAN PENINSULA.

By F. Haas, Frankfurt a. M., Senckenberg Museum.[1]

Residence as a collector for several years in the Pyrenees has brought me to, or it may be assumed sufficiently near to, the standpoint specified by Pilsbry (Manual, XXIV, p. 263; XXV, p. 44) for a monographer of the Pyrenean Abidas and Chondrinas.

In the summer months of several successive years I systematically worked through the Catalonian valleys of the Pyrenees from west to east; also the low country on the southern flank as far as the Ebro, and on the Mediterranean coast even to Valencia. By this investigation I was enabled to make many biologic observations which perhaps disclose to some extent the normal range of variation. On the other hand, the active collecting alluded to supplied extensive material for comparison, such as is essential for the critical handling of variable groups. Together with A. Bofill of Barcelona, I have already reported on my collection in a series of papers, and tried to bring together monographically our knowledge up to this time of the molluscan fauna of the Catalonian Pyrenees. Reference must be made to these monographs for detailed locality records, or for exposition of the variability of species in single valleys. In the present essay, the distribution and variation can only be discussed in broader limits.

The collaboration with A. Bofill has further put me in a position to compare cotypes or at least topotypes of many so-called species which have been described by Fagot and other adherents of the school of Bourguignat. In the collection of the Senckenberg Museum at Frankfurt a. M. there are also at my disposition the types and cotypes of Rossmässler, which he had received from such authors as Küster, Moquin-Tandon, Terver and Charpentier; and in the same museum are to be found the collections of Boettger and Kobelt, with much valuable material for comparison from Asturias and southern Spain.

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[1] Translated by H. A. P.

With such wealth of material as a basis, many questions admit of solution which Pilsbry could not take up in his treatment of the Pyrenean and Iberian species; and again, in many cases the conclusions differ from those accepted by Pilsbry, working with single or few specimens, or often wholly dependent upon published accounts.

In my account of the several species the sequence of Pilsbry's monograph is followed, and references to the literature are repeated only when they appear to be essential. The rather extensive Spanish literature, hardly known in other countries, is cited in the published *Studies of the Malacology of the Catalonian Valleys of the Pyrenees,* so that I have generally confined my references herein to the latter. As these seven *Studies* must often be cited, the full titles are given here; in the text they are cited in the abbreviated form *Est. I, II,* and so on.

Estudi sobre la malacología de les valls pirenaiques.

I. Estudi sobre la fauna malacològica de la vall de l'Essera, by A. Bofill, F. Haas & J. B. d'Aguilar-Amat. In: Treb. Inst. Cat. Hist. Nat., Barcelona, 1919, pp. 9-110, Taf. 1-4.
II. Vall del Noguera Ribagorcana, by A. Bofill & F. Haas. In: Treb. Mus. Cienc. Nat. Barcelona, III, 1920, pp. 1-95, Taf. 1-3.
III. Vall del Noguera Pallaresa, by A. Bofill & F. Haas. In: Treb. Mus. Cienc. Nat. Barcelona, III, 1920, pp. 1-115, Taf. 1-3.
IV. Vall del Segre i Andorra, by A. Bofill & F. Haas. In: Treb. Mus. Cienc. Nat. Barcelona, III, 1920, pp. 1-149, Taf. 1-3.

V. Conca del Llobregat, by A. Bofill & F. Haas. In: Treb. Mus. Cienc. Nat. Barcelona, III, 1920, pp. 1-455, Taf. 1-4.

VI. Conques del Besòs, Ter. Fluvià, Muga i litorals intermitjes, by A. Bofill, F. Haas & J. B. d'Aguilar-Amat. In: Treb. Mus. Cienc. Nat. Barcelona, III, 1921, pp. 1-409, Taf. 1-4.

VII. Vall d'Aran, by A. Bofill & F. Haas. In: Treb. Mus. Cienc. Nat. Barcelona, III, 1921, pp. 1-104, Taf. 1.

Fagot's work—often cited by Pilsbry and myself, and very hard to get—"Catálogo razonado de los moluscos del valle del Essera," appeared in the Crónica Científica de Barcelona, X, 1887—XI, 1888. In it, on pp. 127-131 and 191-194 of Vol. XI, there is a complete list of all forms of the genera *Abida* and *Chondrina* which Fagot considered valid species.

1. **ABIDA POLYODON** (Drap.). Pl. 23, figs. 1, 2.

PILSBRY, Vol. XXIV, p. 270, pl. 44, figs. 1, 2, 3.

Nothing further is to be added to Pilsbry's description except that in some places in regions poor in lime, forms of *polyodon* are developed in which peristomal folds are completely suppressed. Such specimens are mentioned in Est. VI, p. 328, and one is figured, pl. 1, figs. 34, 35, from Setcases, near Camprodon, Prov. Gerona, at 1200 m. elevation, where it was found with seven other entirely similar examples. One of these is drawn in pl. 23, fig. 1.

It may further be mentioned that in a few localities specimens occur which far surpass the size given by Pilsbry as maximal. At Castelldefels, south of Barcelona, for instance, no examples are known to me which fall below 10.5 mm. in length, and one of the specimens I collected there measures 12 mm. long, 3.5 mm. diameter.

A. polyodon is before me from more than sixty localities in Spain. In nearly all of them there lives with the typical form also a smaller one, corresponding to Küster's var. *ringicula.* According to Margier this variety is confined to the valleys of the French eastern Pyrenees and those of the Dép. Aude, while the typical form, unmixed with *ringicula,* lives in the high Pyrenees and the upper Tech valley. My not very abundant French material does not contradict this, but my Spanish certainly does; so that I cannot bring myself to recognize var. *ringicula.* The *Pupa ameliæ* described by Locard from Amélie-les-Bains is nothing else than var. *ringicula,* to which, as Pilsbry correctly thought, Moquin-Tandon's var. *minor* is to be added.

The varieties *attrita* M.-T. and *ventricosa* Locard are forms from the variation-range of the species, never thought by their authors to be independent species. It is otherwise with *Pupa montserratica* Fag. (Ann. Malac., II, 1884, p. 191) from the cloister mountain Montserrat, near Barcelona, which Fagot named from its type-locality as a distinct species beside *polyodon.* I have united it directly with *polyodon,* as it is connected therewith by all transitions. A cotype from Fagot was figured, Est. VI, pl. 3, figs. 18, 19; and here a topotype of *montserratica* is illustrated (pl. 23, fig. 2).

2. ABIDA BRAUNII (Rossm.).

PILSBRY, Vol. XXIV, p. 273, pl. 43, figs. 1-6.

Here too, little is to be added to Pilsbry's account. The range of variation of the species is small, and never reaches such extremes that the specific characters become indistinct. Only the height of the spire and development of the peristome are subject to considerable fluctuations. Westerlund's var. *conispira* from Albarracin, which is unknown to me, belongs, according to the description of the author, within the variation-range of the species, and could therefore apparently be picked out of large lots of *braunii* from other localities.

In France confined to the High and East Pyrenees, *A. braunii* has a wider distribution in the Iberian Peninsula. Besides occurring in the Spanish Pyrenees, it has been found as far as the latitude of Barcelona, enters Arragon over the Ebro as far as the Province Teruel (Albarracin), and is before me in the Kobelt collection likewise in specimens from the Basque country (Orduña and Vergara). I cannot demonstrate its alleged occurrence in Portugal by specimens seen, but by no means deny it; but the record from Algeria by Bourguignat appears to me much in need of confirmation.

3. ABIDA PARTIOTI (Moq.-Tand.). Pl. 23, figs. 3, 4.

PILSBRY, Vol. XXIV, p. 276, pl. 43, figs. 7, 8, 9.

To the synonymy of this species belongs also *Pupa cadica* Fagot, which Pilsbry (Vol. XXIV, p. 314) considered a species of the series of *Abida secale* (Drap.). I studied two cotypes of this form in the Bofill collection in Barcelona, from which I ascertained that *cadica*, quite as Westerlund states, is a form of *A. partioti*, while Fagot placed his "species" near *A. secale*. In the Est. IV, p. 121, pl. 2, figs. 1, 2, I announced this view and sought to prove it by the illustration of one of the two Fagot cotypes.

Pilsbry did not record *A. partioti* from Spain. It is before me from many places in the valleys of the Segre and its Pyrenean affluents. The type locality of Fagot's *Pupa cadica* is the Sierra de Cadi on the Coll de Tanca-la-Porta, at about 1700 m. elevation.

Pupa dupuyi West., which its author changed later to *P. cristella*, and which Pilsbry thought might be *partioti*, belongs in the synonymy of this. A specimen before me identified as *dupuyi* in the Boettger collection, from the type locality, Saint-Sauveur in the High Pyrenees, seems to prove the alleged identity. This specimen is figured (pl. 23, figs. 3, 4), as Pilsbry's figure (Vol. XXIV, pl. 43, fig. 10) is a copy from the *Iconographie*, and consequently is none too distinct.

4. ABIDA SECALE (Drap.). Pl. 23, figs. 5, 6.

The treatment of this species and its varieties or local races by Pilsbry (Vol. XXIV, pp. 306-314) appears to require extension, according to my abundant material from the Pyrenees and Catalonia. Pilsbry (*l. c.*, p. 307) leaves *A. secale* restricted to central Europe, and mentions from the Pyrenees only a few varieties and the subspecies *boileausiana* (Charp., Kstr.); from Spain he mentions no localities. My first opinion was that the typical *secale* really did not reach to and over the Pyrenees, and that there the local race *boileausiana* occurred, and that the described varieties of *secale* from the Pyrenees were referable to that race. Our entire knowledge of *boileausiana* rested hitherto on Küster's description and illustration, and both of these give the impression that we really have to do with a species or subspecies close to *secale*, but yet quite separable from that. However, I now find in the Rossmässler collection a number of specimens of an *Abida*, received from Charpentier, and which he had himself marked as his *boileausiana*. They vary somewhat in size, and the aperture is not equally developed, but they agree, except for small discrepancies in the degree of strength of the several teeth, and in that the supracolumellar tooth is wanting. The aperture thus appears 8-toothed, as Küster said at first, although in the further course of his diagnosis he enumerates 9 teeth. In my opinion, which is sought to be proved by an illustration of one of these Charpentier examples (pl. 23, figs. 5, 6), *P. boileausiana* can no longer be retained as a separate species or subspecies, but must be gathered into the synonymy of *A. secale* as one of the forms of its great range of variation.

Bofill and I (Est. V, p. 368, pl. 3, figs. 12, 13) have been able to bring *Pupa lilietensis* Bofill back to *A. secale* as representing a thin-shelled and therefore only weakly-toothed form. Pilsbry did not know this form, and mentioned it (Vol. XXIV, p. 293) among Bofill names without indication of its affinities.

The other described forms of *secale* from the Pyrenees fall within the range of its variation, and their names in my opinion can pass into its synonymy. Var. *cylindroides* M.-T. is somewhat more *cylindric;* var. *elongata* Sauley somewhat longer than the typical form, 9 mm. instead of 8 mm., and I could specify still longer ones from several localities further south. Var. *phymata* West. is only a thick-shelled form, therefore with a strong peristome, which from its other qualities seems to be a true *boileausiana*. *Pupa fagorum* Fag., of which I can figure a cotype from Aulus, Dép. Ariège (pl. 23, figs. 7, 8, 9), is on the contrary a thin-shelled form without thickened peristome, and completely identical with the var. *abrupta* West. from the same locality. Of *Pupa goudoniana* Fag. and *costata* Fag. I do not venture to speak positively, whether they are referable to *secale* or rather to *A. pyrenæria.* Finally, *Pupa cadica* Fag., which Pilsbry mentioned in the following of *secale,* I have already treated as a synonym of *A. partioti.*

On the Spanish side of the Pyrenees — all of the forms already mentioned were described from the French side—in my *Estudis* I could record *A. secale* in most of the Pyrenean valleys. In the regions further south it had never been recorded, but it is before me from several localities outside of the mountainous regions, along the lower course of the Ebro. There it is notable that the species lives not in the valleys, but on the mountains, sometimes at quite a considerable elevation. On Mt. Mola de Falset, Prov. Tarragona, at about 900 m., partly large specimens up to 10 mm. in length. Also in the Sierra de Cardó near Tortosa at the mouth of the Ebro I took it at an equal elevation, and south of the Ebro it was found at 1000 m. on Monte Caro, opposite Tortosa. The specimens from these southern localities run from 7 to 10 mm. long, and vary considerably in the aperture, yet not so as to require that special names be applied, as all transitions to the typical form occur among them.

5. ABIDA BIGERRENSIS (Moquin-Tandon). Pl. 23, figs. 10 to 14.

Pupa ringens MICHAUD, Compl., 1831, p. 64, pl. 15, figs. 35, 36. Non *Pupa ringens* Jeffreys, Trans. Linn. Soc. London, XVI, 1829, p. 356.

Pupa pyrenaica BOUBÉE, Bull. hist. nat. France, 2nd edit., 1833, p. 10. Non *Clausilia pyrenaica* Boubée, Bull. nat. hist. France, 1st edit., 1831, p. 9.

Pupa bigoriensis ROSSMAESSLER, Iconogr. 1837, Heft V-VI, p. 14, pl. 23, figs. 3, 21. Non *Pupa bigorriensis* Des Moulins, Act. Soc. Linn. Bordeaux, VII, 1835, p. 163, pl. 2, figs. D 1, D 2.

Pupa ringens var. *bigerrensis* MOQUIN-TANDON, Moll. France, 1855, p. 362, pl. 26, fig. 21.

Pupa baillensi DUPUY, Revue Agric. et Hortic. Gers, 1843, p. 3, fig.

Pupa ringens var. *Rossmaessleri* FAGOT, Bull. soc. hist. nat. Toulouse, XV, 1880, p. 204.

Pupa fagotiana LOCARD, Ann. Soc. Agricult. Lyon, (5), IV, 1882, p. 438.

The name *Pupa ringens* Michaud, long in use for this species, is unfortunately preoccupied by *Pupa ringens* Jeffreys; we substitute *bigerrensis* M.-T. for the Pyrenean form.

I must make this species more comprehensive than Pilsbry has done (Vol. XXIV, p. 278). Especially it seems to me necessary to include within the range of its variation *Pupa baillensi* Dup. and *P. bigerrensis* M.-T. (which Pilsbry considered respectively as a species and as a subspecies of *ringens*).

Pilsbry has already shown (Vol. XXIV, pl. 43, figs. 12-15) that *A. bigerrensis* (*ringens*) is rather variable in stature and in the development of the aperture. The varieties *elongata*, *pulchella* and *disjuncta* described by Moquin-Tandon represent only that many single stages in this range of variation, and also Fagot's *P. subringens* gives no sufficient cause for distinction. All of these forms Pilsbry has quite rightly recognized as indistinguishable forms of *ringens*. In reference to *P. bigerrensis* M.-T. and *P. baillensi* Dupuy he could come to no decisive judgment from the want of authentic material, therefore treated these two as forms akin to *ringens*, whereas I dare affirm their complete identity from my original material.

In the Rossmässler collection there are several *P. bigerrensis* (under the name *bigorriensis*), which came from Moquin-Tandon, one of which is figured on pl. 23, figs. 11, 12. It shows that *bigerrensis* altogether resembles the true *ringens* except in the development of the peristome, which is not continuous and is but little thickened. From another collector I possess further specimens from Bagnères-de-Bigorre, the type-locality of *P. bigerrensis*, which differ in no respect from the true *ringens*, even showing the continuous thickened peristome accepted as characteristic of that species.

Now, everyone who has collected pupillids often and at various times of year, knows that full-grown specimens, with the apertural folds of the species, can be found, in which the peristome is not continuous, reflected or thickened. But a few weeks later one can collect the same species at the same place with completely continuous peristome; and not long after, specimens with thickened peristome can be found. Thus it will be understood that a full-grown *Abida* with all the apertural folds the species will have, need not by any means have *completed* the construction of the shell. If it lives in a favorable spot, that is, where lime is abundant, it will continue by degrees to add to the peristome until it becomes continuous and, according to its kind, reflected or thickened. Also the folds and teeth of the aperture increase in strength under such circumstances. However, as the average collector and also the describing author, who seldom collects personally, considers a snail adult when it has finished its increase in size, so he may often describe as a new variety or even species a pupillid which is of full size, but has not reached the full formation of the aperture. Such cases have unfortunately been introduced very often by the young adherents of the Bourguignat school; and also Westerlund has shown his lack of personal experience as a collector by naming immature snails.

The fundamental mistake, however, which has led to all this introduction of needless names, is that authors have thought that they must slavishly hold to the original descriptions, and demand that every species must agree in all details therewith.

This theoretic digression was necessary to explain why I attach little or no importance to differences in the development of the peristome or in the strength of the apertural armature, and why I do not recognize forms which have received names on the ground of such differences.

Pupa bigerrensis M.-T. (Vol. XXIV, p. 280, pl. 43, fig. 11) I consider a not fully-formed *A. ringens;* and as explained above, the name *bigerrensis* must now be used for what has hitherto been considered typical *ringens*. *Pupa baillensi* Dupuy (Vol. XXIV, p. 280) is also an uncompleted, but shorter and thicker *A. bigerrensis* (*ringens*). A specimen of *A. ringens* var. *baillensi* identified by Boettger, from Bayonne, the type-locality, is figured on pl. 23, fig. 10. *P. garumnica* Fagot, from the upper Garonne region, treated by Pilsbry as a variety of *baillensi,* is larger than this, and has a more broadly expanded peristome. A specimen collected by Bofill near Artias in the Valle d'Aran, thus in the upper Garonne valley, serves to illustrate this form in pl. 23, figs. 13, 14.

Contrary to the view expressed by Pilsbry (Vol. XXIV, p. 179), *A. bigerrensis* (*ringens*) is known to me from various valleys on the southern side of the Pyrenees. I never found it outside of the mountains, but there are specimens before me from the Basque country (Orduña and San Sebastian).

6. Abida pyrenæaria (Mich.). Pl. 24, figs. 1 to 10.

To this species of the high Pyrenees I ascribe the following forms, treated by Pilsbry (Vol. XXIV, 286 and following pages) as separate species: *Pupa vergniesiana* Kstr. and its variety *provida* West., *Pupa hospitii* Fag., *P. clausilioides* Boubée, *P. aulusensis* Fag. and *P. petrophila* Fag.

The basis of my treatment is similar to that already discussed under *A. bigerrensis.* The original diagnosis of the species need not be supplemented further, except by saying that the apertural development depends very much upon the geologic constitution of the station, which is further not without influence upon the size of the shell. In some localities *A. pyrenæaria* reaches a length of 8 mm., with a diameter of 3.5 mm.; in others, with a diameter of 3 mm., it is only 6 mm. high; and a third, described under the name *clausilioides,* measures only 2.5 mm. diameter with a length of 7 mm. The shell form also is as mutable as the length. The specimens illustrated in pl. 24, figs. 1, 2, 3, 4, all came from the same place, the Spanish side of the Port de Salau in the Province Lérida, where I collected them close together at an elevation of about 1800 m. They show that the shape may be from narrowly cylindric to bluntly fusiform, the apex more or less acute. The striation of the shell varies a good deal. Alongside of strongly, distantly striate ones, closely and finely striate live, and others in which the kind of striation differs on different whorls, and even almost wholly disappears on the last. The development of the aperture goes through all the stages specified for *A. bigerrensis.*

A series of specimens of *A. vergniesiana* in the Rossmässler collection, received from Charpentier, lies before me, agreeing well with Pilsbry's illustrations (Vol. XXIV, pl. 44, figs. 7, 10, 12). According to these, *vergniesiana* is a thick-shelled form of *pyrenæaria* with the aperture dilated below, and its var. *provida* is nothing else than a weak-toothed form of Michaud's species.

The true *A. pyrenæaria* appears to be little known, as the illustrations of Michaud and of Dupuy, which last Pilsbry has copied (XXIV, pl. 44, fig. 9) are by no means good. The Dupuy figure represents *pyrenæaria* with parietal and angular lamellæ perpendicular to the shell axis, whereas both of them really stand exactly as in *P. vergniesiana*. My figured specimens from Port de Salau (pl. 24, figs. 1 to 4) will show this.

Pupa hospitii was treated by Pilsbry (XXV, p. 37) as a *Chondrina*. In the appendix to the same volume, however, on p. 371, he mentioned it as a form of *pyrenæaria*, in conformity with the conclusion of Bofill and myself (Est. I, p. 91, pl. 4, figs. 10, 11). As I said already (*l. c.*), in *P. hospitii*, from Hospital de Venasque, Prov. Huesca, in the central Pyrenees, I can only see a slender and narrow-mouthed *pyrenæaria*, like the specimens from that place illustrated in pl. 24, fig. 5.

Pupa aulusensis Fag., which Bofill and I have already placed in the synonymy of *pyrenæaria* (Est., III, p. 99, pl. 3, f. 14, 15), is only a more slender, more cylindric form of this species, with weaker apertural folds, and is connected with typical *pyrenæaria* by all transitions, living with it in the same locality. A cotype from Fagot is illustrated, pl. 24, fig. 6.

Pupa aulusensis Fag. is the same as *P. saxicola* M.-T. Fagot chose a new name for it because there was an older *P. saxicola* Lowe. According to cotypes from Moquin-Tandon of his *saxicola*, of which one is figured in pl. 24, figs. 7, 8, 9, there can be no doubt that we have to do with a typical *pyrenæaria*. Küster's illustration of this form, copied by Pilsbry (XXIV, pl. 44, fig. 13) is very imperfectly characteristic.

Finally, *Pupa clausilioides* Boubée, of which I can figure a good specimen from the Boettger collection (pl. 24, fig. 10), is only an especially slender and fusiform shell, otherwise differing in no respect from the range of variation of *A. pyrenæaria*. By its narrow shell it resembles certain forms of *A. affinis* (Rossm.), but by the structure of the aperture it does not belong to this, but to *pyrenæaria*.

Pupa nansoutyi Fag. and *P. occidentalis* Fag. in Westerlund are not known to me, but it appears certain, from their descriptions, that they also are to be referred to *A. pyrenæaria*.

Abida pyrenæaria is a truly Pyrenean snail, not straying beyond the limits of the mountains. On the Spanish side it is known to me only from the highest parts; I never found it below an elevation of 1400 m. In all its localities it is very abundant, upon cliffs and under stones.

The group of Abida affinis (Rossm.).

While all Pyrenean Abidas already discussed prove to be indeed very variable, so as to give occasion for the proposition of many new names, none of these variation-forms proved to be characteristic of definite, well-defined regions, so that none of the new ''species'' or ''varieties'' could be retained as local forms (subspecies). It is otherwise with *A. affinis*, which in the area it inhabits has developed into a series of well-marked forms, which in their respective districts do not intergrade with the others. By the admission of the occurrence of such local races it must not be understood that this species and its subspecies are less variable individually than the Abidas already discussed. In all localities whence I have abundant material—and they are many—it is seen that the shells ocillate between strictly cylindric and distinctly fusiform; and in the latter case the point of greatest diameter may be removed a varying distance from the middle of the shell. With relatively constant length, the diameter is subject to great variation; shells of 11 mm. long may have a diameter of from 2 to 3.5 mm., in fusiform as well as in cylindric shell-forms.

Up to this time, four local races of *A. affinis* are known to me, of which two do not live in the Pyrenees, but in the adjoining mountainous regions southward.

ABIDA AFFINIS AFFINIS (Rossm.).

Vol. XXIV p. 282, pl. 44, figs. 5, 6.

I have only to add to the description (*l. c.*) that the little embayment of the palatal margin of the aperture above is characteristic of this form, and that the basal fold may be degenerate, as happens to be the case with Rossmässler's original series.

With Pilsbry I reckon as synonyms Moquin-Tandon's varieties *cylindrella* and *elongata*. *Pupa eudolicha* Bgt. I view as a slender, abnormally toothless *A. affinis affinis*. Westerlund's var. *saeva* (based upon one specimen!) is surely to be regarded as abnormal, his *Pupa bipalatalis* also as abnormal in the tooth-reduction.

Pupa (Torquilla) hetæra West. (Vol. XXIV, p. 294), *Pupa leptospira* West. (p. 295), and *P. migma* West. (p. 295), all three from the French eastern Pyrenees, are not known to me, and I can therefore not pass judgment upon them; yet they may well belong to *A. affinis affinis*.

In distribution, *A. affinis affinis* is confined to the northern side of the Pyrenees; the known localities lying between the valley of the Tech (La Preste, type-locality) and Bagnères-de-Luchon. The Spanish localities quoted by Pilsbry (*l. c.*, p. 282) pertain to *A. affinis catalonica* (Bof.), the last two, Montserrat and Paramon, to *A. affinis bofilli* (Fag.).

7*b*. ABIDA AFFINIS CATALONICA (Bofill). Pl. 25, figs. 1 to 6.

Pupa catalonica BOFILL, Bull. Soc. Malac. France, III, 1886, p. 157.

Abida catalonica (Bofill) PILSBRY, Man. XXIV, p. 294.

Pupa (Modicella) affinis catalonica BOFILL and HAAS, Est. VI, p. 328, pl. 1, f. 36-45 (full references to literature).

Pupa freseriana Fagot (= *P. affinis* var. *major* Bofill), Crón. Cient. Barcelona, XI, 1888, p. 130.

Pupa perlonga Fagot (= *P. affinis* var. *elongatissima* Bofill), Crón. Cient. Barcelona, XI, 1888, p. 130.

Pupa phthisica BOFILL, Bull. Soc. Malac. France, VII, 1890, p. 258.

It differs from *A. affinis affinis* by the stronger dentition, especially recognizable in the stronger development of the parietal lamella; the columellar lamellæ stands somewhat inclined, not exactly horizontal. The embayment at the upper palatal margin of the peristome is scarcely indicated; the peristome itself in quite mature examples shows a slight plication, similar to that of *A. polyodon* but much weaker. Pl. 25, figs. 1, 2, illustrate this local race from a Camprodon topotype.

Pupa freseriana Fag., from the banks of the Freser at Queralps (pl. 25, figs. 3, 4, a cotype), is a slightly fusiform specimen. *P. perlonga* Fag. from Montagut near Ribas (pl. 25, fig. 5, cotype), a slender, regularly coiled specimen. *P. phthisica* Bof. from Besora (pl. 25, fig. 6, cotype) is a pathologic form, the last whorl departing a little from the axis of the shell.

This local race occurs only on the Spanish side of the Pyrenees, in the valleys of the Catalonian eastern Pyrenees, from those of the upper Llobregat nearly to the Mediterranean.

7*c*. ABIDA AFFINIS MONTSICCIANA (Bofill). Pl. 25, figs. 7. 7*a*.

Pupa montsicciana BOFILL, Bull. Soc. Malac. France, VII, 1890, p. 263.

Abida montsiccana (Bofill), PILSBRY, Vol. XXIV, p. 293.

Pupa (Modicella) affinis montsicciana BOFILL and HAAS, Est. II, p. 83, pl. 2, f. 25-28; Est. IV, p. 118 (full references to literature).

Pupa vidalis J. MALUQUER, Butll. Inst. Cat. Hist. Nat., IV, 1904, p. 40.

Distinguished from *A. affinis affinis* by the presence of a semi-ovate aperture without any embayment, of numerous accessory folds on the parietal wall and considerable size (10 to 12.5 mm.). The figured specimen is a cotype from Portell del Montsech.

Pupa vidalis J. Maluquer remains a *nomen nudum;* it was based upon specimens of *A. a. montsicciana* from Hostal Roig in Montsech.

This local race is confined to the Montsech range, which does not belong to the Pyrenean system, but which extends as a steep wall from the Noguera Ribagorzana to the Segre, in the southern part of the pre-Pyrenean sierras.

7*d*. ABIDA AFFINIS BOFILLI (Fagot). Pl. 25, figs. 8, 9.

Pupa bofilli FAGOT, Ann. Malac., II, p. 189.
Abida bofilli (Fagot) PILSBRY, Manual XXIV, p. 292.
Pupa (Modicella) affinis bofilli, BOFILL and HAAS, Est. V, p. 367, pl. 3, f. 14-17 (complete literature).

Remarkable for its constantly small size (8 mm. high, 2 mm. diam.), weaker folds in the rounded aperture and the thin shell. Apparently to be viewed as an adaptation to the district it inhabits, poor in lime but rich in gypsum. A topotype is figured, pl. 25, figs. 8, 9.

The habitat of this local race is the gypsum-marl formation of the lower Llobregat district; type-locality, the Cloister mountain Montserrat.

7*e*. ABIDA AFFINIS ANDORRENSIS (Bgt.). Pl. 25, figs. 10-13.

Pupa andorrensis BOURGUIGNAT, Rev. Mag. Zool., 2 sér., XV, 1863, p. 153, pl. 14, f. 17-19.
Abida andorrensis PILSBRY, Vol. XXIV, p. 293, pl. 44, f. 14, 15.
Pupa andorrica FAGOT, Hist. Mal. Pyr. Franc. Esp., 1892, p. 94.
Pupa (Modicella) affinis andorrensis BOFILL and HAAS, Est. IV, p. 119, pl. 1, f. 15-23 (complete literature references).
Pupa tuxensis Fagot, in WESTERLUND, Nachr. Bl. D. Mal. Ges., XXXIV, 1902, p. 40. — FAGOT, Butll. Inst. Cat. Hist. Nat., V, 1905, pp. 139, 143.

Actually typical *A. affinis,* as figured by Rossmässler, does not occur in the Segre valley, but a local race of it is found there, resembling *affinis* in general shape of the shell and in structure of the apertural armature, yet distinguished by the stronger and more spreading peristome. This thickening and expansion of the peristome gives the aperture a rounded appearance, and brings about the disappearance of the embayment or shallow sinulus so characteristic of *A. affinis affinis.* Specimens thus characterized, therefore differing from the specific type only in development of the peristome, were named *P. tuxensis* by Fagot. A cotype of this form, from Tuxent at about 1000 m. elevation, is drawn in pl. 25, figs. 12, 13. A higher plane of evolution is represented by the specimens which have the outer and inner margins of the peristome united by a strong callus, forming a continuous peristome, which may even stand free of the last whorl.

Such specimens with continuous peristome, as also those without the connection, either as a mark of age or in consequence of life in a locality rich in lime, can thicken the peristome and form tooth-like foldlets on the inner and outer margins, interposed between the usual folds of the *affinis* type. If this structure of peristomal folds extends upon the upper margin also, we have Bourguignat's *Pupa andorrensis.*

The transition-stages to the complicated *andorrensis* are illustrated in pl. 25, figs. 10, 11, by two specimens from the Congost de Organya in the Segre Valley.

A correct systematic disposition of *andorrensis* has been difficult on account of the peculiar structure of the basal keel and the conformation of apertural folds as inferred from Bourguignat's original figures, since the form has not hitherto been represented in other collections. Bourguignat himself mentioned for comparison *P. polyodon* (Drap.), apparently led astray by the purely superficial similarity of the system of peristomal folds. Bofill and I, by the aid of our extensive material, were the first to recognize *andorrensis* as a local race of *A. affinis.* It is moreover to be intimated that none of the many specimens examined by us attains to the strength of the peristomal folds of Bourguignat's original figure. However, as I have had opportunity to compare Bourguignat's types with the figures he gave, I know that this investigator exaggerated in his figures the peculiarities thought to be characteristic of the snails he was illustrating. With this procedure in mind, the difference between the original figure and our material may be minimized.

A. affinis andorrensis is moreover subject to great fluctuation in length of the shell. In the Congost of Oliana live specimens of 10 mm. long, 3.75 mm. diam., together with others of 12 mm. long and 3 mm. diam.; and one from Isobol in the upper Segre valley measures only 8 mm. long, 3 mm. diam.

This local race is restricted to the valley of the Segre so far as it flows in the Pyrenees, and to its right tributary the Valira, which flows out of Andorra. In the Pyrenean valleys further west, no species of the *affinis* group could be detected; in those towards the east the above-mentioned *A. a. catalonica* (Bof.) lives.

Genus CHONDRINA (Vol. XXV, p. 1).

CHONDRINA (SOLATOPUPA) SIMILIS (Brug.).

PILSBRY, Manual XXV, p. 57, pl. 4, figs. 1-4.

As Pilsbry has said, this species has its southeastern limit in the Spanish Province Gerona, wherein it occurs southward as far as the Ter, thus about to the boundary of Province Barcelona. Only the locality Fonteta lies south of this river. Couturier's record that *C. similis* occurs in Barcelona could not be confirmed by Bofill and me, at least not in case the city of that name was intended. According to Spanish usage, the Province is called by the name of its capital city, so that quite possibly Couturier's material came from Barcelona Province. Though *similis* is not yet detected there, yet it is by no means excluded that it does not live in the northern part, over against Gerona Province.

The variability of Spanish specimens is relatively small, at least as compared with those of the Alpes-Maritimes.

Subgenus CHONDRINA proper.

This includes all of the species following.

The group of Chondrina (Chondrina) bigorriensis (Des M.).

As in *A. affinis* among the Abidas, so *C. bigorriensis* here, has formed a series of local races, which however are less distinct owing to the greater variability of the species. Only in the average can the specimens of a special district be said to be characteristic thereof. Among them there are always scattering specimens which are not separable from the typical form of the species; so that one may venture to say that in this species the formation of local races is not yet completed. Since the size and thickness of the shell fluctuates between wide limits in all localities whence *bigorriensis* is known, and that further, the shape of the aperture is by no means constant, it is very hard to find characters for separation of the races. Here, too, full-grown specimens but with the peristome not completely developed have given occasion for the proposition of new specific names, as will be mentioned under the various local races.

CHONDRINA BIGORRIENSIS BIGORRIENSIS (Des M.). Pl. 26, figs. 1, 2.

PILSBRY, Manual XXV, p. 29, pl. 2, figs. 1, 2, 3, 7.

Pupa moquiniana KUESTER, Conch. Cab., *Pupa*, p. 52, pl. 7, f. 4, 5.

Pupa badia var. *gigantea* ROSSMAESSLER, Iconographie, III, p. 106, pl. 85, f. 937.—*Chondrina gigantea* PILSBRY, XXV, p. 32, pl. 3, f. 7, 8.

? *Pupa cereana* KUESTER, Conch. Cab., *Pupa*, p. 47, pl. 6, f. 9-11.—*Chondrina cereana* PILSBRY, XXV, p. 21, pl. 1, f. 11.

? *Pupa baregiensis* LOCARD, Ann. Soc. Agric. Lyon, III, 1896, p. 187.—*Chondrina baregiensis* PILSBRY, XXV, p. 35.

? *Pupa centralis* FAGOT, Hist. Malac. Pyr. Franc. Esp., 1891.—*Chondrina centralis* PILSBRY, XXV, p. 35.

Pupa (Modicella) megacheilos bigorriensis BOFILL and HAAS, Est. VII, p. 91.

I have nothing to add to Pilsbry's description of this local race. The cotypes before me from Bagnères-de-Bigorre (Hautes-Pyrénées) agree fully with Des Moulins' description and with Pilsbry's illustrations.

Pilsbry (*l. c.*, p. 30) correctly treats *P. moquiniana* Kstr. as a form of *bigorriensis*, not a distinct species. I was able to compare specimens in Rossmässler's collection from the type-locality, Mt. Beudat near Pau (not Beudar, as Pilsbry wrote, p. 31), and to convince myself of the complete identity of Küster's form with *bigorriensis*. One of these examples is drawn in pl. 26, fig. 1.

The form described from the Cirque de Gavarnie (H.-Pyr.) as *Pupa badia* var. *gigantea* has been elevated by Pilsbry to a species. According to the cotypes, of which I figure one on pl. 26, fig. 2, I can see in var. *gigantea* nothing more than an extraordinarily large but otherwise typical *bigorriensis,* which besides its size is distinguished only by the weak development of its teeth and lamellæ. My specimens vary between 11 and 12 mm. high and 4 to 4.5 mm. diameter. Further on we will come to a pronounced giant form of *C. bigorriensis tenuimarginata* (Des M.).

What *Pupa cereana* Kstr. is will probably never be certainly known. According to Küster's illustration we have to do with a species very closely related to *bigorriensis,* perhaps quite identical with it; but the locality records, France and southern Germany, does not permit this view. Westerlund mentions Carinthia, southern France and northern Spain as further localities, whereby the records of Küster become somewhat easier to understand, since his "Süddeutschland" may very well coincide with Westerlund's "Karnten," as in Küster's time Austria-Hungary was still considered a part of Deutschland. But in Carinthia, *C. megacheilos* (Cr. & Jan) occurs, which under the circumstances might be taken to be Küster's *cereana.* The western distribution, southern France and northern Spain, would answer therefore for *C. bigorriensis,* though the conjectures expressed above do not justify placing *cereana* directly in the synonymy of that species.

Pupa baregiensis Locard and *P. centralis* Fagot, both from the High Pyrenees, are known to me only by the descriptions, which indicate relationship with *bigorriensis.* Considering the species-splitting of their authors, we will not go far wrong if we conclude that their species were based upon individual variations of *C. bigorriensis bigorriensis.*

Bofill and Haas have mentioned this local race under the name *P. megacheilos bigorriensis,* and have recorded it from the Valle d'Aran, the part of Spain lying on the north side of the Pyrenees, through which flows the uppermost Garonne.

For the distributon of *C. bigorriensis bigorriensis* can be given in general: the High Pyrenees. Moquin-Tandon mentions also *C. b. tenuimarginata* from there (at Luchon); but I convinced myself, by examples from him in Rossmässler's collection, that there had been an exchange of specimens. We may therefore regard *C. b. bigorriensis* as the local race of the French High Pyrenees, that is, the region of the watershed of the Garonne and the Adour. This form is not known to me from the Spanish High Pyrenees; all I saw from there are *C. b. tenuimarginata,* which on the French side is restricted to the eastern Pyrenees.

CHONDRINA BIGORRIENSIS TENUIMARGINATA (Des M.). Pl. 26, figs. 3 to 9, 12.

Chondrina tenuimarginata PILSBRY, XXV, p. 31, pl. 2, figs. 4-5.

Pupa leptocheilos FAG., Bull. Soc. Hist. Nat. Toulouse, 1879, p. 241.

C. tenuimarginata var. *elongatissima* PILSBRY, p. 32, pl. 2, fig. 6.

C. goniostoma PILSBRY, p. 33, pl. 2, figs. 13-14.—*C. goniostoma* forma *aucta* PILSBRY, p. 33. — *C. goniostoma* var. *juliensis* PILSBRY, p. 34, pl. 2, figs. 15-16.

Pupa (Modicella) megacheilos goniostoma BOFILL & HAAS, Est. VI, p. 128, pl. 1, figs. 46-55 (full literature upon occurrence in Spain).

Pupa crassata FAG., Crón. Cient. Barcelona, XI, 1888, p. 127.—*Chondrina crassata* PILSBRY, XXV, p. 36.

Pupa angulata FAG., Crón. Cient. Barcelona, XI, 1888, p. 104.—*Chondrina angulata* PILSBRY, XXV, p. 34.

Pupa adeodati FAG., Butll. Inst. Cat. Hist. Nat., VI, 1906, p. 134.

As Pilsbry states, this form is almost identical with the typical *bigorriensis,* only usually somewhat more fusiform and lighter colored, and with the aperture somewhat angular below. These characters are pretty universal, but not so constant but that their gradual development has given proofs of the relation of species and variety.

The Fagot name *leptocheilos,* which its author changed later to *leptochilos,* does not denote a new form, but was only a substitute for the septensyllabic *tenuimarginata.*

Des Moulins' var. *elongatissima* of *tenuimarginata* merely stands for a much lengthened form.

P. goniostoma Küster is in my opinion completely identical with *tenuimarginata,* a view nearly reached by Pilsbry. The distributional areas of both are the same. Westerlund's forma *aucta* of *goniostoma* is distinguished by the possession of 6 palatal folds, which apparently are the upper-, lower- and infra-palatals of typical *goniostoma,* to which two weak supra-palatals and one basal have been added. *C. goniostoma* var. *juliensis* Bourguignat is characterized by the possession of two folds at the insertion of the right lip-margin.

Bofill and Haas, in their first six *Estudis* imposed the name *P. megacheilos goniostoma* upon *Chondrina bigorriensis tenuimarginata.*

Pupa crassata Fagot, from the Escalas de Sopeira in the valley of the Noguera Ribagorzana, is a form with strongly expanded, thick peristome, such as may be formed by specimens living where the country rock is calcareous. In pl. 26, fig. 3, I figure a cotype.

Pupa angulata Fagot, from the valley of the Esera, is that form of *C. b. tenuimarginata* in which the angularity of the lower margin of the aperture is most pronounced. A topotype is figured, pl. 26, fig. 4.

Finally, *Pupa adeodati* Fagot is, according to a communication from Father Adeodat Marcet of the Monastery of Montserrat, a deformed specimen of *C. b. tenuimarginata* found on the mountain of the same name.

The three specimens from the valley of the Noguera Ribagorzana, between Pont de Suert and Sopeira, shown in pl. 26, figs. 5, 6, 7, 8, give an idea of how little constancy there is in the characters of the aperture (strength of the teeth, angle of the lower part of the peristome, strength or expansion of the peristome, etc.). They were collected on the same cliff, and with equally strong peristomes show three different forms of aperture. The difference in size is not so considerable as in other localities to be discussed later. A race with very weak development of peristome lives on the mountains near the coast in the northern part of Barcelona Province (Caldas de Montbuy, San Miguel del Fay and so on); it shows the lower peristomal angle especially strong, as in pl. 26, fig. 9, a specimen from Caldas de Montbuy.

The following will serve to illustrate the size variation, in specimens measured from El Bruch, near Montserrat: 7.5 to

11 mm. high, 3.5 to 4 mm. in diameter; one specimen has a diameter of 4.5 mm. with height of only 8 mm.

Upon the mountains of the mouth of the Ebro, where *C. b. tenuimarginata* has been found in recent years, a form lives which can only be compared with the form *gigantea* of *C. b. bigorriensis* of Gavarnie. It measures up to 10.5 mm. high with 4.5 mm. diameter, and is notable for the extremely fine striation of the shell and weak structure of the apertural lamellæ. Besides the two palatals there are indications of 2 supra- and 1 infrapalatal. A specimen from Forat Negre at the Hospitalet del Infant, near Vandellós, Prov. Tarragona, is drawn in pl. 26, fig. 12.

C. bigorriensis tenuimarginata is known up to this time from the French and Spanish East Pyrenees, the Spanish High Pyrenees, westward to the Rio Salarar in Navarra and the coastal region skirting the Pyrenees south of the mouth of the Ebro. Included in this area lies the isolated mountain mass of Montsech, where a special local race of *bigorriensis* has been evolved, the *C. b. microchilus* Bofill, about to be discussed.

In his treatise ''Estudio crítico de la Pupa megacheilos Cristofori et Jan y de algunas formas derivadas de ella que viven en España'' (Real Sociedad Espanola Hist. Nat., Madrid, Tomo Extraordinario, del 50 Aniv., 1921, pp. 309-336, pl. 19), F. Azpeitia treated of the south Pyrenean local races of *Abida bigorriensis* (which species he considered a local race of *C. megacheilos*), and investigated the forms *goniostoma, leptocheilos, adeodati, microchilus, bigorriensis, elongatissima, gigantea, juliensis* and *angulata* in their relations to this. His results are almost the same as those to which my own studies have led; only he did not recognize *C. bigorriensis bigorriensis* as a local form independent of *C. b. tenuimarginata.* This was evidently because his research material was from the Aragonian part of the range, whilst *A. b. bigorriensis* occurs only in the southern part of these mountains. Having before him no authentic material, he took *Pupa microchilus* Bof. to be merely a small-mouthed form of *tenuimarginata,* whereas I hold it to be the local race characteristic of the Montsech range.

Azpeitia figures 8 specimens on his plate, representing as many forms, and demonstrating their untenability. Among the figured specimens happened to be one of *A. b. tenuimarginata* form *elongatissima* Des M. from Foz de la Biniés in Aragon, 15.5 mm. in length.

CHONDRINA BIGORRIENSIS MICROCHILUS (Bofill). Pl. 26, fig. 10.

Pupa leptochilus var. *microchilus* BOFILL, Act. Mem. I Congr. Nat. Esp. Zaragoza, 1909, p. 198; Treb. Inst. Cat. Hist. Nat., I, 1915, p. 44, pl. 6, f. 2.

Pupa (Modicella) megacheilos microchilus BOFILL and HAAS, Est. II, p. 84, pl. 3, f. 1, 2; Est. III, p. 199.

"This title is proposed for a form which I found in the valley of the Noguera Ribagorzana and in the Congost de Sabinós between Sot de Fet and Sot de Blancafort.

"It is distinguished chiefly by its strongly lengthened shape and its small aperture" (*Bofill*).

From eight localities in Montsech there are specimens of a form of *bigorriensis* before me which all differ from typical *bigorriensis* and its local form *tenuimarginata* by the peculiarities mentioned by Bofill. On pl. 26, fig. 10, is figured a Bofill cotype of his *P. microchilus* from Ca'n Quinquillà de la Serra in Montsech. Its small, round aperture with the very strongly developed angular lamella and the strong columellar lamella are very characteristic.

In size the Montsech form varies relatively little. The figured specimen measures 8.5 mm. long, 3 mm. diameter.

This local race, which differs a good deal from other forms of *bigorriensis* by the constancy of its apertural and size proportions, is restricted to the Montsech chain in the Province Lérida.

The group of Chondrina avenacea (Brug.).

As will appear in the following exposition, I cannot, from the examination of my Pyrenean and north-Spanish material —several thousand specimens strong—arrange the Chondrinas of the Pyrenean center in a special *Group of C. farinesi* as Pilsbry has done (XXV, p. 45). What led Pilsbry to this arrangement, which seems to me unnatural, was in the first place that the forms in question are all more or less deficient in teeth or lack them altogether, while typical *avenacea* occurs in the Pyrenees but seldom. Further, that the forms erected as distinct species and varieties are in large part known only by descriptions, being scarcely to be found in collections, which naturally made a correct estimate of them impossible.

I hope to be able to demonstrate by my arrangement that the characters which have appeared certain marks of distinction to the authors of the many Pyrenean species and varieties of *Chondrina*, such as shape and size of the shell, number of whorls, strong or superficial striation, structure of the peristome, and not least, the number and combination of apertural teeth and folds, can be shown to lead into one another, even among specimens taken in the same place, and therefore can not be used for specific and varietal distinction.

The forms placed together by Pilsbry (*l. c.*) belong, according to my researches, to two different local races. The first, which must take the name *farinesi*, is restricted to the High and East Pyrenees, as well as in Aragon, about to the Ebro, and northern Catalonia as far as the latitude of Barcelona. The second, which groups around *P. jumillensis* Pfr., belongs to the eastern half of southern Spain, and comes into contact with the preceding race in the north. How the Chondrinas from Asturia and the Basque provinces which muster about *P. kobelti* Hid. are related to the first two local races I cannot certainly ascertain without collecting experience and more ample material than is now at my disposal. The similarity of this group to more fully toothed forms of the Pyrenean *farinesi* is great, but the two do not seem to me to be identical.

In Pilsbry's list of Pyrenean Chondrinas of the group of *bigorriensis* there is a series of forms which I must refer to the *avenacea* group, and which belong in three form-series I have defined.

10*a*. CHONDRINA AVENACEA FARINESI (Des M.). Pl. 27, figs. 1 to 5.

Synopsis of the combinations of apertural teeth of Chondrina avenacea farinesi *now known, with the names which have been applied to them respectively, and references to* Manual, Vol. XXV.

No.	*Par.*	*Col.*	*Pal.*	*Names and remarks.*
1.	0	0	0	*farinesi* Des M. and var. *obesa* Bgt.; var. *subcarinata* Bgt. (XXV, pp. 45-47, pl. 5, f. 1, 2); *speluncae* Loc. (XXV, p. 47).
2.	0	0	1	
3.	0	0	2	
4.	0	0	3	One specimen! Gerona.
5.	0	0	4	
6.	0	1	0	*microdon* West (XXV, p. 49).
7.	0	1	2	
8.	0	2	0	One specimen! Gerona.
9.	0	2	2	
10.	1	0	0	*farinesi* var. *dentiens* M. T. (XXV, p. 47, pl. 5, f. 4).
11.	1	0	2	
12.	1	1	0	*farinesi* var. *biplicata* Bgt. (XXV, p. 47); *jumillensis* var. *ascendens* West. (XXV, p. 47).
13.	1	1	1	
14.	1	1	2	
15.	1	1	3	
16.	1	2	0	*ignota* Fag. (XXV, p. 51).
17.	1	2	1	
18.	2	1	0	*jumillensis* var. *C*, Bof. (Bull. Soc. Mal. Fr., III, 1886, p. 154); *longini* Fag. (XXV, p. 48).
19.	2	1	1	*massotiana* Bgt. (XXV, p. 52, pl. 5, f. 5).
20.	2	1	2	*penchinatiana* Bgt. (XXV, p. 53).
21.	2	1	3	
22.	2	2	0	*penchinatiana* var. *confusa* West. (XXV, p. 55).
23.	2	2	1	Three specimens; Segre valley.

24.	2	2	2	*sexplicata* Bof. (XXV, p. 53) = *ilerdensis* Fag. (XXV, p. 56); *sexplicata* var. *minor* Bof. (Ann. Junta Cienc. Nat. Barcelona, II, 1917, p. 545).
25.	2	2	3	*avenacea* Brug. (XXV, p. 10, pl. 1, f. 4-6), and var. *domicella* West. (XXV, p. 54); *aureacensis* Loc. (XXV, p. 14).
26.	2	2	4	*duplicata* Kstr. (XXV, p. 14, pl. 1, f. below f. 7).
27.	2	3	2	One specimen; Escalas de Sopeira.
28.	3	2	4	

The above table will serve at the same time for a list of synonyms of this form. The literature may be found in Vol. XXV as cited above. Besides this, it is to be found in the *Estudis* of Bofill and Haas as follows: I, p. 91; II, p. 87, pl. 3, f. 9, 10; III, p. 101; IV, p. 125, pl. 2, f. 5-26; V, p. 372; VI, p. 334; VII, p. 92.

During the preparation of the seven Parts of these *Estudis*, Bofill and I several times changed our point of view regarding the local races in question. As we at first, in the valley of the Esera, only found specimens which represented Bourguignat's *P. penchinatiana*, we continued them under that name. When we studied those of the neighboring valleys eastward, we found in the course of time all transitions from *penchinatiana* to the toothless *farinesi*, so that the latter name, as the oldest, was chosen to denote it. In the valley of the Llobregat, finally, the typical *avenacea* and even more fully toothed forms were added to those already treated, so that we reached the opinion that all the tooth-reduction forms could not be separated from *avenacea*; thus we placed them under this name in the last three of our *Estudis*.

This opinion can no longer be held today, since I have been able to study material of *avenacea* in great quantity from outside of Spain and the Pyrenees. The recognized constancy of the apertural characters of this species in all other parts of its area of distribution is so sharply detached from the mutability and plasticity of the shell-form in the region now concerning us, that one may well venture to say that here we have to do with a distinct local race, which on the ground of priority will naturally take the name *farinesi*.

The material investigated by me, about three-fourths of it collected by myself, runs up to about 10,000 specimens. The more detailed results of the count of apertural teeth and folds —arranged by localities—may be found in the pages of our *Estudis* cited, to which reference must be made; their repetition in this place would take us too far. Only the results of a few especially interesting localities can be noticed here.

The list of tooth-combinations given above will serve to interpret the following exposition. It contains all the combinations of apertural teeth known to me from the Pyrenees and northern Spain, from the wholly toothless *farinesi* up to a form exhibiting 9 teeth. I have ascertained 28 such combinations, only a small part of them, fortunately, have been provided with names; the names of each named combination being given in the list. As will be seen, several combinations have been named more than once.

Among 121 specimens from the Congost of Organyà, Segre valley, were present:

Combination	1, 1 specimen.	Comb.	19, 17 specimens.
"	10, 1 "	"	20, 33 "
"	12, 64 specimens.	"	24, 5 "

The size fluctuates between: length 4.5 to 5 mm., diam. 1.25 to 1.75 mm.

455 examples from El Bruch, Llobregat valley:

Comb.	1, 77 spec.	Comb.	15, 1 spec.
"	2, 2 "	"	18, 49
"	3, 6 "	"	19, 16 "
"	6, 9 "	"	20, 217 "
"	7, 6 "	"	21, 2 "
"	10, 14 "	"	24, 11 "
"	11, 6 "	"	25, 10 "
"	12, 17 "	"	26, 1 "
"	14, 9 "	"	28, 1 "

The smallest specimen measures, length 4, diam. 1.75 mm., having 6 rather coarsely rib-striate whorls. The largest, length 6, diam. 2.5, with 7½ nearly smooth whorls.

458 examples from Montserrat contain:

Comb.	1,	93	spec.	Comb.	14,	11	spec.
"	3,	7	"	"	16,	65	"
"	5,	1	"	"	18,	42	"
"	6,	24	"	"	19,	6	"
"	7,	11	"	"	20,	158	"
"	11,	7	"	"	21,	1	"
"	12,	23	"	"	24,	6	"

One of the smallest measures: length 4 mm., diam. 2 mm., having 6 rather distinctly rib-striate whorls. The largest example measures: length 7 mm., diam. 3.25 mm., having 7½ finely hair-striate whorls.

Among 231 specimens from Gerona, there were:

Comb.	1,	187	spec.	Comb.	8,	1	spec.
"	3,	2	"	"	10,	6	"
"	4,	1	"	"	12,	1	"
"	6,	8	"	"	14,	1	"
"	7,	6	"	"	25,	18	"

Smallest specimen: length 5.5 mm., diam. 2 mm., 6¼ nearly smooth whorls. Largest: length 7 mm., diam. 3 mm., 8 distinctly hair-striate whorls. The abrupt transition from the relatively few-toothed combination 14 to the 7-toothed combination 25, is quite remarkable compared with the preceding lists.

Still more marked is the absence of such transition in the following case: Castellfollit, Prov. Gerona, 26 examples, as follows:

Comb.	1,	1	spec.	Comb.	1,	20	spec.
"	6,	1	"	"	15,	3	"
"	13,	1	"				

Smallest, length 5 mm., diam. 2.25 mm., 6½ strongly hair-striate whorls. Largest, length 6, diam. 2 mm., 8 lightly rib-striate whorls.

Certain localities afford only a few combinations. Thus, in 135 examples from Pobla de Segur, in the valley of the Noguera Pallaresa, the combinations 19 and 20 occur in equal numbers. The smallest example measures: length 6 mm., diam. 2.5 mm., having 7½ nearly smooth whorls. The largest: length 10 mm., diam. 3 mm.; 9 lightly hair-striate whorls.

Over 300 specimens from the Congost dels Collegats near Pobla de Segur, belong in equal parts to the combinations 11 and 14. Smallest measures: length 4 mm., diam. 2 mm., and has 6½ lightly rib-striate whorls. Largest: length 5 mm., diam. 2.25 mm., 7½ nearly smooth whorls. This small, slender form will be discussed further.

Valley of the Garona de Ruda in the Valle de Aran, thus on the northern side of the Pyrenees. Over 100 specimens, all with the combination No. 25, the smallest measures, length 6.5, diam. 2.5 mm., 6¾ lightly rib-striate whorls. Largest, length 7, diam. 2.5 mm., 7¾ strongly hair-striate whorls.

The measurements cited suffice to show that the variability of the characters considered is considerable, even among specimens of the same locality. Consequently they will be found sufficient to explain why I unite under the oldest name *farinesi* all of the mutation-forms of the present *Chondrina.*

Although in the course of my collecting I gave serious thought to the discovery of some general relation between the predominance of a certain tooth-combination or a certain average size of shell to a special locality, I could ascertain nothing positive of this kind. Only a single correspondence between the structure of shell and aperture on the one side and ecologic conditions of the station on the other, appears to me demonstrable. In the canyon-like gorges of the pre-Pyrenean sierras, which have been called "congosts," I always found 4-toothed forms of *C. avenacea farinesi* with more or less strongly striate or rib-striate shells, together with strongly ribbed forms of *Pomatias obscurus esseranus* Fag., whilst weak-toothed forms of this *Chondrina* with smooth specimens of the same *Pomatias* lived together. The stations of snails of the first category are all remarkable for their dryness and lack of vegetation, in consequence of their great insolation, and were restricted to the wider parts of the congosts, which however formed a large part of those I could search on the dry and sterile high flanks of the sierras. On the contrary, the smooth snails, of which the Chondrinas were weak-toothed, were to be found only in the narrowest parts of the congosts, and in the narrow side ravines, in which water trickles down the rocks, and the sun's rays do not penetrate directly.

All of the folds do not participate equally in the tendency to reduction noticeable in the synopsis of apertural dentition given at the beginning of this discussion. Generally the simplification of apertural armature proceeds in about the following order: the lower-palatal shows the greatest tendency to disappear; after it comes the infracolumellar lamella. These two are very often lacking together, whereas the presence of columellar and infracolumellar with lower-palatal lacking is one of the greatest rarities, which I found in only three among all of the specimens examined. Of the remaining folds, the upper-palatal is the next to be suppressed. After that, the parietal lamella may disappear, while the angular lamella is the last to go.

As we have already said, all tooth-combinations do not occur in all localities. Usually those of the first or the second half, or the middle of our tooth-combination table predominate. But not all combinations to be found in one locality are present in equal strength. Thus among the 450 specimens from El Bruch, with nineteen combinations, there are two dentition-forms with 77 and 217 specimens. Among the 458 specimens from Montserrat, divided between fifteen combinations, two, with 93 and 158 specimens, predominate.

A striking exception to the examples just mentioned is the typical *avenacea*, to which all of the 37 specimens from Capellades and 3 from Vallbona belong, to the exclusion of other tooth-combinations. These two localities lie in the valley of the Rio Anoya, tributary to the Llobregat, which appears to be a refuge for *C. avenacea avenacea*.

The forms of possible tooth-combinations which have received names have been sufficiently indicated in our combination table, but a few critical remarks may be added.

Pupa speluncæ Loc., from the Grotto of Eauxbonnes, appears to me completely identical with *farinesi* as understood by Des Moulins.

Of *Pupa microdon* West., a topotype from Montserrat is illustrated in pl. 27, figs. 1, 2.

Pupa jumillensis var. *ascendens* West. seems to be completely identical with the form described by Bourguignat as *Pupa jumillensis* var. *biplicata*. Of course neither have anything to do with forms of *C. jumillensis,* which occurs only in southeastern Spain, but are a form of *C. avenacea farinesi* which agrees with *jumillensis* in its tooth-combination.

Also *P. ignota* Fag. has been combined with *jumillensis,* even supposed to be the typical form of that as described by Pfeiffer; but since its type-locality was said to be the Hautes- and Basses-Pyrénées, it cannot be placed in the synonymy of Pfeiffer's species, but denotes the northern representative of the same tooth-combination.

Pupa longini Fag. had earlier been termed *P. jumillensis* var. *C* by Bofill. It is not by any means restricted to Aragon, but is found in many places.

P. penchinatiana var. *confusa* West. differs from *penchinatiana* Bgt. only by the possession of an infracolumellar lamella.

P. ilerdensis Fag. is synonymous with *sexplicata* Bof., of which a topotype is shown in pl. 27, fig. 3. Bofill described this form as *P. penchinatiana* var. *sexplicata,* while Fagot disputed the specific estimate and therefore ventured to apply a new name. *P. sexplicata* var. *minor* Bof. applies to particularly small examples.

P. domicella West., at first said to be 6-toothed, but which in the further course of the original description came into the seven teeth proper to typical *avenacea,* cannot be separated from this species, equally with *P. aureacensis* Loc.

P. duplicata Kstr. I look upon as a strongly-toothed *avenacea,* such as occurs now and then among typical specimens.

P. massotiana Bgt. and *P. penchinatiana Bgt.,* the most abundant forms of the pre-Pyrenean sierras, were illustrated by Pilsbry only by copies of the original figures. For this reason I figure the first in pl. 27, fig. 4, the second in pl. 27, fig. 5, the specimens being from Pobla de Segur.

C. avenacea farinesi is relatively rare in the Aragonian Pyrenees, though it is known from there and from the mountains of Navarra as far as the valley of the Rio Salazar. Eastward towards Catalonia, it increases gradually in abundance, and chiefly in the combinations Nos. 19 and 20. In the valleys of the two Nogueras the combination 24 is added, while in the Segre valley, nearly all combinations between 1 and 24 are to be found. In the district of the Llobregat, including in the south the Montserrat district and the plain of Barcelona, 23 of the 28 tooth-combinations occur. Further east, in places in Province Gerona, combination 1 predominates; combination 25 is also present in a few places, but the transitions between them are always incomplete.

On the French side of the Pyrenees, *C. a. farinesi* is generally reported, but the forms deficient in teeth do not appear to extend there. With this the whole distribution of this local race is specified.

CHONDRINA AVENACEA PULCHELLA (Bof.). Pl. 27, fig. 6.

Pupa pulchella BOFILL, Bull. Soc. Mal. France, III, 1886, p. 161.—FAGOT, Crón. Ciént. Barcelona, XI, 1888, p. 128.—BOFILL, Treb. Mus. Cienc. Nat. Barcelona, I, 1915, p. 49, pl. 6, fig. 9.—*Chondrina pulchella* Bof., PILSBRY, Manual, XXV, p. 54.

Pupa (Modicella) avenacea pulchella BOFILL & HAAS, Est. II, p. 40, pl. 3, figs. 7-8; III, p. 44; IV, p. 124.

Pupa penchinatiana (non Bourguignat) BOFILL, Act. Mem. I. Congr. Nat. Esp. Zaragoza, 1909, p. 200.

? *Pupa (Torquilla) pulchella* var. *manotiana* WESTERLUND, Nachr. Bl. D. Mal. Ges., 1894, p. 54. — *Chondrina pulchella* var. *manotiana* PILSBRY, XXV, p. 55.

Distinguished from *C. avenacea farinesi* by the altogether more fusiform shape, that is, becoming smaller above and below.

Bofill's type is an extremely small specimen, measuring: length 4.5, diam. 1.5 mm. My examples vary between, length 4 to 7 mm., diam. 2 to 3 mm. The smallest specimens I found high on Montsech on the Coll d'Ares, at 1200 m. above the sea. I doubt the correctness of Bofill's statement that his type measured only 1.5 mm. diameter, for I have never found one so slender among my many hundred specimens. This size record influenced Pilsbry (XXV, p. 55) to think that *P. pulchella* was perhaps related to *Granopupa granum*. I figure a Bofill cotype from the Valle d'Ager in Montsech (pl. 27, fig. 6).

Whether Westerlund's var. *manotiana* belongs to *pulchella* seems to me unproven, as the general locality "Spain" is given. Perhaps it is a tooth combination (Par. 2, Col. 1, Pal. 2) pertaining to some other Spanish local race of *C. avenacea*. Although by no means so variable in apertural dentition as *avenacea farinesi*, yet *pulchella* is not altogether constant. The following five tooth-combinations have come to my notice:

Parietal	1	2	2	2	2
Columellar	1	1	1	2	2
Palatal	2	1	2	1	2

C. avenacea pulchella is confined to the Montsech Range, where it replaces *C. a. farinesi* of the surrounding territory, with great constancy in the above-mentioned differential characters.

CHONDRINA AVENACEA JUMILLENSIS (Pfr.). Pl. 27, figs. 7, 8, 9.

Pupa jumillensis PFEIFFER, Mon. Hel., III, 1853, p. 540.—*Chondrina jumillensis* PILSBRY, XXV, p. 49.—*Pupa jumillensis* (non Pfeiffer) ROSSMAESSLER, Icon. III, p. 110, pl. 85, fig. 943.

Chondrina jumillensis guiraonis PILSBRY, XXV, p. 51; XXIV, Taf. 47, fig. 9.—*Chondrina "guiraoensis* Rm.," PILSBRY, XXIV, p. 372, Explanation of plates.

Pupa jumillensis var. *triplicata* BOFILL, Bull. Soc. Mal. France, III, 1886, p. 154.

Pupa tarraconensis FAGOT, Crón. Cient. Barcelona, XI, 1888, p. 129.

This local form has never been comprehensively treated, as the *Estudis* of Bofill and Haas reached only to the limit of its area. Only *P. tarraconensis* extends into the Llobregat region (Est. V), and was noted thence as a form of *C. avenacea farinesi*. In a later work (Mol.luscos terrestres i d'aigua dolça de la regió de Tortosa, in: Butll. Inst. Cat. Hist. Nat. Barcelona, XIX, 1919, pp. 128-131), Bofill and Haas referred to forms belonging here as *Pupa (Modicella) avenacea*.

I have now been able to study material from 22 localities, in 412 specimens, and it appears fitting to give the data of each locality, to show the latitude of variation. The order of localities is from north to south.

In the following paragraphs, *a* in the tooth-formula denotes presence of an angular lamella. The number of specimens is enclosed in parenthesis following the formula.

Sitges, Prov. Barcelona (in Rossmaessler, Icon. III, p. 110, as "Sitchez"), Sanchez Comendador leg., 8 examples, all a–1–0. Length 4 to 5, diam. 2 to 2.5 mm.

Forat Negre near Vandellós, Prov. Tarragona, Dr. P. Font Quer leg., 2 specimens, all a–0–0. Length 4 to 5.5, diam. 2 to 2.5 mm.

Mount Montsant, Prov. Tarragona, Dr. P. Font Quer leg., 13 specimens. 0–0–0 (1); a–1–0 (9); 2–1–0 (3); 2–1–½ ½ (3); 2–2–0 (1); 2–2–2 (8). Length 4.75 to 7.25, diam. 2.25 to 3 mm., 6½ to 8 whorls.

Mount Mola de Falset, Prov. Tarragona, F. Haas leg., 9 specimens. 0–0–0 (1); 0–1–0 (1); a–0–0 (1); 1–1–0 (1); and 2–1–0 (5). Length 5 to 7.5, diam. 2.5 to 3.5 mm.

Sierra de la Picosa at Mora, Prov. Tarragona, F. Haas leg., 1 example, 0–0–0.

Alfara, Prov. Tarragona, F. Haas leg., 14 specimens, as follows: 0–0–0 (1); a–1–0 (5); 2–1–0 (5); and 2–1–2 (3). Length 4 to 5.5, diam. 2.5 to 2.75 mm.; 5¾–7 whorls.

Sierra de la Mola de Tortosa, Prov. Tarragona, 1000-1200 m., F. Haas leg., 4 specimens, all a–1–0. Length 4.5 to 5.25, diam. 2.5 mm.

Roquetas near Tortosa, Prov. Tarragona. Longinos Navás leg., 36 examples, as follows: 0–0–0 (2); a–0–0 (5); a–1–0 (21); a–1–½ (2); 2–1–0 (6). Length 4.5 to 6, diam. 2.5 to 3 mm.; 7–7½ whorls.

Barranco del Salt del Cabrit, 1000 m., Monte Caro near Tortosa, Prov. Tarragona, Dr. P. Font Quer leg., 24 specimens, as follows: 0–0–0 (2); 0–1–0 (2); a–1–0 (3); 1–1–0 (1); and 2–1–0 (16). Length 5 to 6.5, diam. 2.5 to 3 mm.; 6½-7½ whorls.

La Cénsola, 1400 m., Monte Caro near Tortosa, Prov. Tarragona, Dr. P. Font Quer leg., 27 specimens, as follows: 0–0–0 (1); 0–1–0 (1); a–1–0 (1); and 2–1–0 (24). Length 5 to 6.5, diam. 2.25 to 3 mm.; 6½–7½ whorls.

Monte Caro near Tortosa, Prov. Tarragona, Dr. P. Font Quer leg., 1 example, a–1–0.

Foot of Montsiá near Tortosa, Prov. Tarragona, Dr. P. Font Quer leg., 49 examples, thus: 0–0–0 (12); a–0–0 (4); a–1–0 (27); 0–1–0 (5); and 2–1–0 (1). Length 5 to 7, diam. 2.5 to 3 mm.; 6½–7½ whorls.

Peak of the Montsia near Tortosa, Prov. Tarragona, Dr. P. Font Quer. leg., 15 specimens: 0–0–0 (1); a–1–0 (3); 2–1–0 (6); 2–1–$\genfrac{}{}{0pt}{}{\frac{1}{2}}{\frac{1}{2}}$ (3); and 2–2–0 (2). Length 5 to 6, diam. 2.75 to 3 mm.; 6½–7½ whorls.

Cenia near Tortosa, Prov. Tarragona, Longinos Navás, leg., 3 examples: a–0–0 (2); a–1–0 (1).

Puertos de Beceite near Tortosa, Prov. Tarragona, northern side, Dr. P. Font Quer leg., 23 specimens: 0–0–0 (4); a–0–0 (2); 0–1–0 (1); a–1–0 (3); 2–1–0 (13). Length 4.5 to 6, diam. 2.75 to 3 mm.; 6½–7½ whorls. Shell from finely to coarsely hair-striate.

Fredes, Puertos de Beceita, south side, Prov. Castellón de la Plana, Longinos Navás leg., 30 specimens: a–0–0 (4); 0–1–0 (3); a–1–0 (23). Length 5.5 to 7, diam. 2.75 to 3 mm.; 6½ to 7½ whorls. Shell smooth to finely hair-striate.

Peñarroyo, Prov. Tereul, Longinos Navás leg., 35 examples: 0–0–0 (9); a–0–0 (11); 0–1–0 (2); a–1–0 (12); 2–1–0 (1). Length 5 to 6.5, diam. 3 to 3.5 mm.; 6 to 7½ whorls.

Játiva, southward from Valencia. Dr. P. Font Quer. leg., 24 specimens: 0–0–0 (15); a–½–0 (1); a–1–0 (2). Length 5.5 to 7, diam. 2.75 to 3.25 mm.

Sierra de Biar, Prov. Alicante. Dr. P. Font Quer, leg., 24 specimens: 0–0–0 (20); a–0–0 (4). Length 5 to 6.5, diam. 3 to 3.25 mm.; 5½ to 6½ whorls.

Alicante, one specimen, 0–0–0.

Alcaráz, Prov. Albacete, Hidalgo leg., 3 specimens, all 2–1–2. Length 6, diam. 3 mm.

Jumilla, Prov. Murcia. Guirao leg., 8 specimens: a–1–0

(6); 2–1–0 (2). Length 5, diam. 2.5 to 3 mm. Rossmaessler's original series of his *P. jumillensis* (= *jumillensis guiraonis* Pils.).

Orihuela Prov. Murcia, Guirao leg. Series from Rossmaessler's collection in the Senckenberg Museum, Frankfurt a. M., 21 specimens: 2–1–1 (1); 2–1–2 (16); 2–0–2 (1); 2–2–2 (2); 2–2–3 (1). Length 6.5, diam. 3 to 3.5 mm. Series from Pfeiffer's collection in the Natural History Museum in Stettin, 5 specimens: 0–1–0 (1); a–2–0 (2); $\left\{\begin{matrix}a\\ \frac{1}{2}\end{matrix}\right.$–1–0 (1); $\left\{\begin{matrix}a\\ 1\end{matrix}\right.$–1–0 (1). Length 6.5 to 7, diam. 2.75 to 3 mm. Since the Pfeiffer specimens (type and 4 cotypes) wholly agree in measurements with those from Orihuela in the Rossmaessler collection, I think that I will not go wrong in taking this place as the type-locality of the species. Pfeiffer's record "Habitat prope Jumilla et Orihuela" (*l. c.*, p. 541), is to be restricted in conformity with this.

Tous on the Jucar, Prov. Murcia. C. Pau, leg., 11 examples: 2–2–1 (2); 2–2–2 (9). Length 6 to 7, diam. 2.75 to 3 mm.

Cartagena, Prov. Murcia. W. Kobelt, leg., 3 examples, all 0–0–0. Length 5.5, diam. 3.25 mm.

In the following list the symbol *a* denotes that only the angular lamella is developed on the parietal wall. ½ denotes that the tooth represented is only vestigeal.

	Par.	*Col.*	*Pal.*	*Number of specimens.*	*Names.*
1.	0	0	0	80	
2.	0	1	0	16	
3.	a	0	0	29	
4.	a	½	0	11	
5.	a	1	0	141	*P. jumillensis guiraonis* Pils.
6.	a	1	½	2	
7.	a½	1	0	1	
8.	1	1	0	2	
9.	a	2	0	2	*P. jumillensis* Pfr.
10.	a1	2	0	1	
11.	2	0	2	1	
12.	2	1	0	82	*P. tarraconensis* Fagot.
13.	2	0	1	1	
14.	2	1	½ ½	6	
15.	2	1	2	22	
16.	2	2	0	3	
17.	2	2	1	2	
18.	2	2	2	19	
19.	2	2	3	6	

It will be seen by this list that combination 5, (a–1–0), corresponding to *C. jumillensis guiraonis* Pilsbry, occurs most frequently, 141 out of the 427 specimens investigated having this formula. The combinations 1, (0–0–0), with 80, and 12, (2–1–0), with 82 specimens, are almost as strong in numbers.

All of the specimens examined, however much they may vary in size, sculpture, number of whorls and dentition, agree in the following characters which differentiate them throughout from other local races of *C. avenacea.*

The shape of the shell is less fusiform, being conic, with rounded, not tapering base; the whorls are more swollen, the suture thereby deeper, and the aperture broader and more rounded. In *C. avenacea jumillensis* I have never found the laterally compressed aperture, thus appearing higher than wide, significant of other local races. A peristome really reflected throughout or on one side only, this race never forms;

at most there is only a light thickening of the inner rim of the mouth.

Pupa jumillensis Pfeiffer, as understood by its author, has never been found again, as its tooth-combination a–2–0 was not present in my material. What Bourguignat (Moll. S. Julia de Loria, pl. 2, figs. 7-9, copied by Pilsbry, XXV, pl. 5, figs. 6, 7) figures under this name, is according to the apertural structure, a form corresponding to *C. avenacea farinesi*, and not the true *jumillensis*. I think I can explain how the confusion arose whereby the name *jumillensis* was employed by Pfeiffer as well as Rossmaessler, but used for two different forms. Rossmaessler received from Guirao, besides the smaller form coming from Jumilla, and which he named *jumillensis* (the *jumillensis guiraonis* of Pilsbry), also a series of larger snails from the locality Orihuela, which were more variable in dentition than the smaller ones. He sent authentic specimens of both to Pfeiffer, who, under the impression that the larger ones pertained to Rossmaessler's still unpublished name *jumillensis*, described one of them under that name. His type happened to have the unusual combination a–2–0, while in the rest of the original series, only the combinations Nos. 7, 10, 11, 13, 15, 18 and 19 of our list are represented. Now in view of the great variation in teeth and size of this race already given under localities, it is quite intelligible that Pfeiffer and Rossmaessler selected different types, and considered their species to be different, whilst from the standpoint of our present knowledge we may confidently unite them under the Pfeifferian name.

It must further be stated that in the original series of smaller *jumillensis* (*jumillensis guiraonis* Pils.) there are, besides 6 examples with the combination given as typical, a–1–0, also 2 with the combination 2–1–0.

Pfeiffer's original series of his *P. jumillensis* is indeed, as shown by the locality list, by no means homogeneous. Of the five specimens therein, only two have the combination given as typical, a–2–0, the other three standing in quite different places in our list of combinations. From this it follows that *P. jumillensis* cannot be accepted in the narrow sense which the wording of the original diagnosis seems to prescribe, but that the right course is to look upon the *jumillensis* of Pfeiffer and of Rossmaessler as one and the same race. Further, it must be brought out that the dimensions ascribed to his species by Pfeiffer (length 8, diam. 3.75 mm.) by no means tally; his largest specimen having the tooth-combination given by him as typical, and which I have designated as type, with an accurate caliper measures only 7 mm. long and 3 mm. diameter. A cotype with similar dentition, but smaller, 6.5 x 2.75 mm., is figured on pl. 27, fig. 8.

Also in the original series of the smaller *jumillensis* (the *jumillensis guiraonis*), there are besides 6 examples with the combination given as typical, a–1–0, also 2 with the combination 2–1–0. A specimen of this original series is drawn in pl. 27, fig. 7.

Pupa tarraconensis Fagot had already been described by Bofill as *P. jumillensis* var. *triplicata*. Fagot, who viewed it as a separate species, could not retain this name on account of *Pupa triplicata* Studer, and had to give it a new one. This form represents the combination 2–1–0, which frequently, however, passes into a–1–0. The snail from Sitges, Prov. Barcelona, mentioned by Rossmaessler (Iconogr. III, p. 110), which was considered by Fagot to belong to his *tarraconensis,* shows all of these last named combinations. A typical example from Mt. Mola de Falset, Prov. Tarragona, is illustrated on pl. 27, fig. 9.

The distribution-area of *C. avenacea jumillensis* is to be defined in the north only by further collecting. In the latitude of Barcelona it is contiguous to that of *C. a. farinesi,* with apparently a narrow zone of intermingling of the two. Papiol, Bofill's locality of his var. *triplicata,* therefore that of *tarraconensis,* lies close to Barcelona, and undoubted *C. avenacea farinesi* is known to me from the same place. Sitges is the northernmost locality where *jumillensis* alone lives. In the west, Peñarroyo, Prov. Teruel, is the furthest place yet known. Southward we know it as far as the Cartagena-Jaën line.

CHONDRINA AVENACEA KOBELTI (Westerlund). Pl. 27, figs. 13, 14, 15.

Pupa kobelti "Hidalgo" WESTERLUND, Fauna Pal. Binnenconch., p. 102. — *Chondrina kobelti* PILSBRY, Manual, XXV, p. 38.

Chondrina kobelti ordunensis PILSBRY, Manual, XXV, p. 39, pl. 3, f. 2-4.

Pupa (Modicella) avenacea BOFILL and HAAS, Mol.luscos recullits en Asturias en 1918, in: Butll. Inst. Cat. Hist. Nat. Barcelona, XIX, 1919, pp. 25-34 (full literature for Asturia).

This local race is before me from 10 localities. The data for the several lots follow, arranged from east to west, the number of specimens, in parenthesis, following the tooth formula.

Cestona near Guipuzcoa, Prov. Bilboa, Hidalgo leg., 9 specimens, all with 2–2–4 teeth. Length 5 to 6, diam. 2.5 to 3 mm.

Altamira, Sierra de Gorbea, Prov. Bilboa, Hidalgo leg., 3 examples, all 2–2–3. Length 5 to 6, diam. 2.5 to 3 mm.

Orduña, Prov. Vitoria, W. Kobelt leg., 12 specimens: 2–2–3 (8); 2–2–4 (3); 2–2–5 (1). Length 5.5 to 7, diam. 2.5 mm.; 7–7½ whorls.

Asturia, W. Kobelt leg., 13 specimens, all 2–2–3. Length 4 to 5.25, diam. 2 to 2.25 mm.; 5¼ to 7 whorls.

Santona near Santander, Prov. Santander, Hidalgo leg., 4 specimens: 2–2–3 (3); 2–2–4 (1). Length 5-6, diam. 2.75 to 3 mm.

Potes near Santander, J. Rosals leg., 70 examples: 2–2–2 (1); 2–2–3 (48); 2–2–4 (21); 2–1–3 (1). Length 4.75 to 8.5, diam. 2.5 to 3.5 mm.; 6-8 whorls.

Gijon, Prov. Oviedo, Hidalgo leg., 3 examples, all 2–2–3. Length 3.5 to 4, diam. 2 to 2.25 mm.

Monsacro near Oviedo, Hidalgo leg., 17 specimens: 2–2–3 (16); 2–2–4 (1). Length 6 to 8, diam. 2.75 to 3.25 mm.; 7½–8 whorls.

Caldas de Oviedo, Hidalgo leg. Type-locality of *P. kobelti*. 46 specimens: 2–2–2 (2); 2–2–3 (36); 2–2–4 (8). Length 4 to 8, diam. 2 to 3.25 mm.; 6–7½ whorls.

Covadonga near Oviedo, Hidalgo leg., 3 specimens: 2–2–3 (1); 2–2–4 (2). Length 5.25, diam. 2 mm.

In the investigation of these 182 specimens it appears that only 5 tooth-combinations are present, to which is to be added that given for *P. kobelti* by Westerlund. The combinations follow:

No.	*Par.*	*Col.*	*Pal.*	*No. of specimens.*	*Names.*
1.	2	1	3	2	*C. k. ordunensis* Pils.
2.	2	1	4	0	*Pupa kobelti* West.
3.	2	2	2	3	
4.	2	2	3	131	
5.	2	2	4	45	
6.	2	2	5	1	

Combination No. 4 (2–2–3) is by far the most frequent, represented by the great majority of specimens received from Hidalgo as *Pupa kobelti.* Westerlund's combination, 2–1–4, did not occur in my material. The single occurrence of 2–2–5 is noteworthy.

The dimensions vary between 4 and 8.5 mm. long, 2 and 3.5 mm. diameter, with 5½ to 8 whorls.

Common to all specimens examined are the smooth, strong shell, the narrow, basally rounded-triangular aperture, and the presence of a peristome which is reflected on the columellar side only. Internal thickening of the aperture would not be noticed. In the large number of apertural teeth as well as in the general form of the shell, *kobelti* approaches typical *C. avenacea* far more than the other Pyrenean and Iberian local races, but the basally triangular aperture is characteristic throughout. This character lends large specimens some similarity to *C. bigorriensis tenuimarginata,* but only superficially, for the absence or only weak development of the spiral lamella indicates their place in the *avenacea* group. Moreover, these large specimens connect with the smallest ones by a flawless chain of transition forms. An example of this large form of *C. a. kobelti,* from Potes, near Santander, is drawn in pl. 27, fig. 15.

Pupa kobelti has generally been ascribed to Hidalgo, who sent out many specimens under this name but never published it. Westerlund was the first to publish a description, and thus he must be accepted as the author. It happened that in its description there was some such substitution as occurred in the case of *P. jumillensis.* Westerlund selected as type a specimen having an extremely rare tooth-formula: 2–1–4; a combination which has not been encountered again. The specimens received from Hidalgo as *P. kobelti,* in all 179, show for the most part (131 examples) the combination 2–2–3; 45 have 2–2–4, and only 3 have 2–2–2 teeth. The specimen drawn in pl. 27, figs. 13, 14, with the combination 2–2–4 represents therefore what Hidalgo required for his *P. kobelti.* It is from the hot springs (*Caldas*) of Oviedo, collected by Hidalgo himself.

Pilsbry's subspecies *ordunensis* falls within the range of variation of *C. a. kobelti,* as will be seen by the table given above. It is represented in my material by only 2 examples.

The area of distribution of *C. a. kobelti* is not yet definable with certainty. All of the localities now known lie in the parts of the Basque and Asturian Provinces draining into the Bay of Biscay.

Since the above was written a full discussion of the species has been published by Dr. Florentino Azpeitia Moros, in Bol. Soc. Iberica Ciencias Nat., XXII, 1923, pp. 105-111.

CHONDRINA ARAGONICA (Fag.). Pl. 26, fig. 11.

Pupa arigonis BOFILL, Bull. Soc. Malac. France, III, 1886, p. 160; not of Rossmaessler.

Pupa aragonica FAGOT, Crón. Cient. Barcelona, XI, 1888, pp. 105 and 128.—BOFILL, Treb. Mus. Cienc. Nat. Barcelona, I, 1915, p. 46, pl. 6, fig. 5.

Pupa (Modicella) aragonica BOFILL and HAAS, Est. I, p. 43, pl. 4, f. 8, 9; II, p. 39, pl. 3, f. 5, 6; III, p. 100.

Chondrina massotiana var. *aragonica* PILSBRY, Manual, XXV, p. 54.

Pupa saltus FAGOT, Crón. Cient. Barcelona, XI, 1888, pp. 106, 129.—BOFILL and HAAS, Est. I, p. 89, pl. 4, f. 8, 9.

"Shell rimate (the crevice partly covered by the columellar lip), cylindric-conic, lengthened, somewhat translucent, slightly glossy, of yellowish to reddish color, striate (the striæ extremely fine, hair-like, irregular, arcuate and close); spire conic or cylindric-conic, awl-shaped; apex yellowish, smooth, papillar; 10 slightly convex somewhat flattened whorls, rapidly but regularly increasing, separated by an impressed suture, the last whorl the largest, compressed but not carinate basally, ascending to the aperture; aperture oblique, lunate-oval, 5-toothed as follows: 1 small, oblique, deeply placed columellar, visible only in an oblique view; 1 lamelliform, compressed, immersed parietal; 1 tooth-like angular fold; 2 quite short palatals, of nearly equal length, placed deep in the throat; peristome expanded throughout, white, approaching the inner margin and thus narrowing the aperture; columellar margin nearly straight, the outer margin longer and arcuate. Length 6 to 9, diam. 2 to 2.5, height of the aperture 2, width 1.5 mm.'' (*Fagot*).

As Pilsbry could only give a copy of Westerlund's diagnosis of this species, the original diagnosis of Fagot is given here. Some details are to be added, as it is by no means unexceptionable. The angular lamella may be present only as a thin deposit of callus; the parietal may be completely lacking. The columellar is never lamelliform, but always a tubercle. The peristome is conspicuous by its white reflection, its margins never united. The peristome is well thickened, but reflected only on the columellar margin; its thickening is visible in the aperture as an internal callus in old individuals.

A typical example from the valley of the Noguera Ribagorzana at Torre de Tamurcia is figured on pl. 26, fig. 11.

Bofill and I could compare cotypes of *Pupa saltus* Fagot, by which it appeared that this species is merely a more slender, thin-shelled, so to speak ''rickety'' form of *aragonica,* in which, besides, both palatals are suppressed. A cotype was illustrated in our Est. I, pl. 4, figs. 8, 9.

In distribution, this species is restricted to a few valleys of the Pyrenees. It is to be found rather abundantly in the valleys of the Cinca and the Esera, is less common in the valley of the Noguera Ribagorzana, and is very scarce in that of the Noguera Pallaresa, so that in fact it occurs only in four valleys of the central Pyrenees, and only on the Spanish side.

The close affinity of *C. aragonica* to *C. avenacea farinesi* is unmistakable, but the constancy of its characters is so great that I am impelled to award it specific rank. We will see in *C. arigonis* and *C. gorbeana* two further cases of local races of *C. avenacea,* which within their special areas have developed into constant species.

CHONDRINA ARIGONIS (Rossm.).

Manual, XXV, p. 34, pl. 2, figs. 10-12, 17-18.

In this species we see a form of *C. avenacea jumillensis* which has become constant in its differential characters, fully illustrating what was said above of *C. aragonica.* I could investigate Rossmaessler's series, consisting of about 20 specimens, varying only in size and thickness. Comparing with the original series of *jumillensis* Rossm. (*jumillensis guiraonis* Pils.), one cannot escape the conclusion that the two are quite identical except as to the apertures. The aperture is formed entirely as in *aragonica* so far as the peristome is concerned, the dentition differing by having two columellar teeth developed.

CHONDRINA GORBEANA Pilsbry.

Manual XXV, p. 56, pl. 3, fig. 12.

This species too, I view as a form of the *avenacea*-complex which has become constant, and in this case, *C. avenacea kobelti* was evidently the parent form. The characters of peristome are entirely similar to those of *aragonica* and *arigonis.* The peristome is thickened within; on the columellar side somewhat expanded, but not on the palatal side. Tooth reduction has gone further than in the two preceding species, there being present only 1 angular and 1 parietal lamella as well as 1 columellar.

Pilsbry conceives that this species may be a degenerate form of the *bigorriensis* group, which in view of its other qualities I do not believe; on the contrary, everything favors my view that it belongs with *avenacea kobelti.*

There are before me 21 Chondrinas from Orduña, collected by Kobelt, thus from near the type-locality, and which both Kobelt and Boettger had in their collections under the name *Pupa farinesi* var. *biplicata.* They are identical with *gor-*

beana, and exhibit the tendency of the parietal lamella (which is very weak and deep in the throat, therefore readily overlooked) to complete degeneration. The dimensions are between 6 to 7 mm. long, 2.5 to 3 wide; the number of whorls from 6 to 7½.

CHONDRINA LUSITANICA LUSITANICA (Pfr.).

Manual XXV, p. 40, pl. 4, figs. 5, 6.

Pupa obliterata Kstr. (Manual XXV, p. 52, pl. 5, figs. 9, 10), which Pilsbry thought resembled east Spanish forms, is strongly and irregularly striate according to Küster's diagnosis. It may have been based upon a weakly ribbed and weak-toothed specimen of *C. lusitanica*.

CHONDRINA LUSITANICA VASCONICA (Kobelt). Pl. 26, figs. 13, 14.

Chondrina vasconica PILSBRY, Manual XXV, p. 39.
Pupa lusitanica FISCHER, Manuel de Conch., p. 202; not of Pfeiffer.
Pupa (Modicella) lusitanica BOFILL and HAAS, Butll. Inst. Cat. Hist. Nat. Barcelona, XIX, 1919, p. 33.

Kobelt's otherwise expressive diagnosis, which Pilsbry (*l. c.*) repeated, requires alteration as to the apertural dentition. I looked through his entire original series, among them the type, and found in this and all the other specimens the tooth formula 2–2–4, the suprapalatal fold always being weaker and never reaching the peristome; the basal-fold stands quite in the lower angle of the aperture, and is as strong and long as the two palatals. The cotype figured in pl. 26, figs. 13, 14, shows these conditions.

This form can stand as a dwarf form of the typical *lusitanica*, with which it agrees in nearly all points. It differs from that by the free, long, spiral lamella, which is not in the line of projection of the angular lamella but standing a little higher and beginning in advance of the end of the angular. The teeth are just as strongly developed as in the typical *lusitanica*, and thus the narrower mouth, consequent on the general smallness of the shell in comparison with *lusitanica*, appears quite obstructed.

The 15 examples of the original series all measure: length 6, diam. 2.5 mm.; the 9 from Potes near Santander, length 5.5 to 6.5, diam. 2.5 mm. The records of *lusitanica* from Asturia by earlier authors are apparently referable to *C. l. vasconica,* which appears to replace *lusitanica* in the Asturian and Basque Provinces.

CHONDRINA DERTOSENSIS (Bofill). Pl. 27, figs. 10, 11, 12.

Pupa dertosensis BOFILL, Bull. Soc. Malac. France, III, 1886, p. 162.—WESTERLUND, Fauna Pal. Binnenconch., p. 103.—BOFILL, Ass. Exc. Cat., XI, 1890, p. 200.—*Chondrina dertosensis* PILSBRY, Manual, XXV, p. 36.—HAAS, Butll. Inst. Catal. Hist. Nat., 1924, p. 55, pl. 1, f. 6*a, b.*

Pupa (Modicella) avenacea (in part), BOFILL and HAAS, Butll. Inst. Cat. Hist. Nat. Barcelona, XIX, 1919, pp. 129-130.

Pupa (Modicella) aff. *jumillensis* HAAS, Butll. Inst. Cat. Hist. Nat. Barcelona, XVIII, 1918, p. 72.

Pupa (Modicella) avenacea dertosensis HAAS, *tom. cit.,* pp. 141, 142.

Chondrina dertosensis (Bof.) HAAS, Butlleti Inst. Catalana d'Hist. Nat., 1924, p. 55, pl. 2, f. 6*a, b.*

After we (Bofill and Haas) had considered this species to be a form of *C. avenacea,* I find myself compelled to change my mind and treat it as a good species of the group of *C. lusitanica.* It is much more variable in size and teeth than Bofill indicated, as will be seen in the following list of localities, arranged from north to south. Number of specimens is enclosed in parenthesis following the tooth formula.

Mt. Montsant, Prov. Tarragona, Dr. P. Font Quer leg., 10 examples: 2–1–2 (1); 2–2–0 (1); 2–2–2 (8). Length 5.5 to 7, diam. 2.5 to 3 mm.; 7 to 8 whorls.

Mt. Mola de Falset, Prov. Tarragona, Dr. P. Font Quer leg., 9 examples: 2–2–4 (8); 3–2–4 (1). Length 5 to 6.75, diam. 2.25 to 2.5 mm.; 7-8 whorls.

Composines near Mora, Prov. Tarragona, on Triassic limestone, F. Haas leg., 2 examples, 2–2–2. Length 6.5, diam. 3 mm. Shell strongly rib-striate, thick.

Sierra de Cardó, Prov. Tarragona, A. Bofill leg., 29 examples, cotypes: 2–1–0 (14); 2–2–0 (12); 2–2–1 (2); 2–2–2

(1). Length 5.5 to 7, diam. 2.5 to 3.25 mm.; 6¼ to 7¼ whorls; the shell finely rib-striate.

La Cénsola, Monte Caro near Tortosa, Prov. Tarragona, Dr. P. Font Quer leg., 11 examples: 2–2–0 (2); 2–2–1 (2); 2–2–2 (7).

Prov. Cuenca, 14 examples, all 2–2–3. Length 7, diam. 3 mm. Shell finely hair-striate.

The 80 specimens examined divide among the following eight tooth-combinations:

No.	*Par.*	*Col.*	*Pal.*	*No. of specimens.*	*Names.*
1.	2	1	0	14	
2.	2	1	2	1	
3.	2	2	0	15	
4.	2	2	1	2	
5.	2	2	2	10	*Pupa dertosensis* Bofill.
6.	2	2	3	21	
7.	2	2	4	16	
8.	3	2	4	1	

Little is to be added to Bofill's good diagnosis, repeated by Pilsbry (Man. XXV, 36). The apex is smooth, the following 3-4 whorls always showing a pronounced hair-striation, which on the latest whorls generally becomes weaker; only the thick-shelled specimens from the Triassic limestone of Camposines are distinctly rib-striate throughout. The shell in these last-named specimens is opaque, while in all others examined it is translucent horn-brown. The base of the last whorl lacks a distinct crest; only a light lateral compression is present. The angular lamella is united with the spiral lamella.

My specimens from the Sierra de Cardó are Bofill's cotypes, but only one of them has the combination 2–2–2 attributed to the species, and the other combination said to occur, 2–2–3 is not represented at all. On pl. 27, figs. 10, 11, I figure one of this lot with the combination 2–2–1. Fig. 12 of the same plate illustrates an example with 2–2–2 teeth, from the Sierra de Cardó, opposite Montsiá on the south side of the Ebro.

In a single specimen from the Mola de Falset there was a twin lamella alongside the angular, indicated in the table by the formula 3–2–4.

From the Sierra de las Dientes de la Vieja, near Granada (Hidalgo leg.) there are before me 24 examples of a form showing only the combination 2–1–2, and which agree with *dertosensis* in everything except that they lack a spiral lamella. Also one specimen collected by W. Kobelt in Ronda (Prov. Málaga) is quite similar to typical *dertosensis* except in possessing no spiral lamella. It has 2–2–2 teeth. Whether the forms from these two southern localities are referable to typical *dertosensis* I do not venture to decide.

C. dertosensis in its typical development, that is, having a spiral lamella, is up to the present time known only from the mountain ranges along the lower course of the Ebro in Tarragona Province, and also in Cuenca Province. Its occurrence in the Provinces Castellón de la Plana, Valencia and Teruel is to be expected. If the two forms from the region of Granada and of Rondo are considered to be *dertosensis,* then its distribution will coincide with that of *C. avenacea jumillensis,* including the whole of southeastern Spain.

CHONDRINA CALPICA (West.). Pl. 24, figs. 11, 12, 13.

Pupa calpica WESTERLUND, Nachr. Bl. D. Mal. Ges., 1872, p. 27; Malak. Bl., XXI, 1874, p. 58, pl. 2, f. 6-8.—*Chondrina calpica* PILSBRY, Manual, XXV, p. 41, pl. 3, f. 10, 11.

Pupa tingitana KOBELT, Jahrb. D. Mal. Ges., IX, 1882. p. 71.—WESTERLUND, Fauna, p. 103.—*Chondrina calpica* PILSBRY, Manual, XXV, p. 41, pl. 3, fig. 9.

Pupa tingitana var. *algesiræ* KOBELT, Jahrb. D. Mal. Ges., IX, 1882, p. 71. — WESTERLUND, Fauna, p. 103. — *Chondrina tingitana algesiræ* PILSBRY, Manual, XXV, p. 42.

? *Pupa gratiosa* WESTERLUND, Ann. Mus. Acad. St. Petersburg, III, 1898, p. 167.—*Chondrina gratiosa* PILSBRY, XXV, p. 37.

Ten specimens of Westerlund's *Pupa calpica* from Gibraltar are before me, varying in dentition of the aperture as follows: 1–2–2 (4); 1–2–3 (3); 2–2–2 (2); 2–2–3 (1). From this it appears that Westerlund's diagnosis, in which he ascribes only one parietal lamella, in the lack of an angular, as a constant character of his *calpica,* is incorrect. Three out of ten specimens received from his own hand show a distinct angular lamella, and in some of the remaining examples it is at least indicated.

The general form of the shell runs from turreted fusiform to turreted ovate, and in the first of these aspects reminds one of the proportions given by Kobelt for his *tingitana* from Tetuan. This latter form agrees also otherwise with *calpica* in the tooth arrangement from 1–2–3 to 2–2–3, and by the strong, remote and irregularly standing ribbing of the surface, so that I have to consider both as one and the same species. Naturally Kobelt's var. *algesiræ* of *tingitana* will pass into the synonymy of *calpica.* I have been able to compare 18 cotypes of this, which show that the dentition ascribed to it by Kobelt is not at all constant. Instead of 2 palatal folds said to be characteristic of it, 12 specimens have 3. In this form also, the angular lamella is not always absent; nearly half of the specimens I examined show a distinct one.

A cotype agreeing with Kobelt's description of his var. *algesiræ* is illustrated, pl. 24, fig. 11. Length 7.5, diam. 2.7 mm.; 8⅓ whorls.

Pupa gratiosa Westerlund, supplied with 1–2–4 teeth, may turn out to be a form of this species, but at present this disposition of it is conjectural.

[Two specimens of *C. calpica* from Tetuan are figured (pl. 24, figs. 12, 13) from a lot of four in coll. Bryant Walker. Three of them have two palatal folds as in fig. 13, corresponding to var. *algesiræ* Kob.; the fourth having a basal fold in addition, fig. 12. Angular lamella is distinct to vestigeal. Both are stouter in figure than the cotype of *algesiræ* figured, measuring 7 to 7.3 mm. long, 3 wide; 7½ whorls.]

APPENDIX II.

PALÆOZOIC PUPILLIDÆ (?).

Certain fossils of Carboniferous (Pennsylvanian to Permian) age have been referred to the Pupillidæ. At present their affinities must be considered doubtful, pending the discovery of Mesozoic forms connecting them with Pupillidæ or other families. They are of great interest as evidence that a highly diversified Pulmonate fauna existed at that time; but whether their affinities are with Auriculidæ or with such Orthurethrous families as Pupillidæ, Tornatellinidæ, and others, or with several of these, remains to be worked out. With them occur snails resembling Endodontidæ and Helicinidæ.

ANTHRACOPUPA Whitfield.

Anthracopupa Whitf., Amer. Journ. Sci., XXI, Feb. 1881, p. 126; Ann. New York Acad. Sci., V, 1891, p. 607. Monotype *A. ohioensis.*

The shell is ovate, ventricose, minute (the type about 3.3 mm. long), finely striate axially, of few, convex whorls (about 4 in the type); aperture vertical, the peristome thickened and reflected, with a small but deep rounded sinulus above, insertions remote; a median parietal and a columellar lamella developed. *A. ohioensis* Whitf., pl. 32, figs. 11, 12, 13.

While the shape, the small size and the transverse parietal margin of the aperture are Pupillid characters, yet the possibility that *Anthracopupa* belongs to the Auriculid series is strongly suggested by the resemblance of the aperture and peristome to those of some Carychiidæ.

Anthracopupa ohioensis Whitfield, Amer. Journ. Sci., XXI, 1881, p. 126, f. 1-4; Ann. N. Y. Acad. Sci., V, p. 607, pl. 16, f. 15-17. Pennsylvanian: near Marietta, Ohio.

ANTHRACOPUPA (?) DUNKARDIANA Stauffer & Schroyer, Geol. Surv. of Ohio, 4th Ser., Bull. 22, 1920, p. 144, pl. 11, f. 12-16. Permian, Dunkard Group: base of the Lower Washington limestone, half mile south of Pleasant Grove, Belmont Co., Ohio.

MATURIPUPA new genus.

Ovate, Tornatelliniform shells having shortly ovate aperture with thin, slightly expanded outer and reflected columellar margins, their insertions distant. Parietal margin decidedly oblique. A long, median parietal lamella and an entering columellar lamella present. Type *M. vermilionensis* (Bradley), pl. 32, figs. 17, 18.

MATURIPUPA VERMILIONENSIS (Bradley). *Pupa vermilionensis* Bradley, Amer. Journ. of Sci. (3), IV, 1872, p. 87, f. 1, 2.—Dawson, Amer. Journ. of Sci. (3), XX, p. 410, f. 7, 8, 9, 14*c*. Pennsylvanian: concretionary limestone of underclay of Coal No. 6, Wabash Valley Section, at Pelly's Fort, Vermilion River, Illinois.

This small, densely microscopically striate shell, 3.6 mm. long, has more resemblance to the Tornatellinidæ or to some Auriculidæ than to any Pupillidæ, and it probably does not belong to the latter family.

DENDROPUPA Owen.

Dendropupa OWEN, Palæontology, or a systematic summary of extinct animals and their geological relations, 1860, p. 79 (species alluded to but not mentioned by name).—DAWSON, Amer. Journ. Sci. (3), XX, 1880, p. 408, for *P. vetusta.*

The shell is shaped like *Microceramus,* subcylindric below, tapering in the upper half, of rather numerous whorls (9 in the type-species), the initial whorl smooth, the next marked with rows of little pits which gradually pass into continuous striæ (fig. 21, × 16); subsequent whorls closely ribbed axially. Aperture toothless, the peristome slightly reflected with widely separated insertions.

Type *Pupa vetusta* Dawson. Pl. 32, figs. 21-24.

While this genus has generally been referred to the Pupillidæ, it has an equal resemblance to such Urocoptidæ as *Microceramus.* That there is any direct relationship with the latter genus is highly improbable, though it might be an ancestral form of the same family. The type species, *D. vestusta* has the general figure of *Abida,* and is about 8 mm. long. Its egg capsules containing the young shell have been found (pl. 32, fig. 24, × 16).

DENDROPUPA VETUSTA (Dawson). *Pupa vetusta* DAWSON, Quart. Journ. Geol. Soc. London, XVI, 1860, p. 270, f. 1-3; Arcadian Geology, 1868, p. 383, f. 149; Amer. Journ. of Sci. (3), XX, 1880, p. 405, f. 1-4, p. 412, f. 14*a*; with var. *tenuistriata,* pp. 406, 412, f. 14*b*.—SALTER, The Geologist, 1861, p. 178, f. 1.—*Dendropupa vetusta* FISCHER, Journ. de Conchyl., vol. 33, 1885, p. 101. Middle Pennsylvanian: South Joggins, Nova Scotia, in stump of *Sigillaria.*

DENDROPUPA WALCHIARUM Fischer, Journ. de Conchyl., vol. 33, 1885, p. 100, fig. 1. Middle Permian: Chambois (Saone-et-Loire).

Species of uncertain position.

PUPA BIGSBYI Dawson, Amer. Journ. Science (3), XX, 1880, p. 410, f. 5, 6.—*Dendropupa bigsbyi* FISCHER, Journ. de Conchyl., 1885, p. 102. Middle Pennsylvanian: South Joggins, N. S., with *P. vetusta.*

A smaller species than *D. vetusta,* smooth, and according to Dawson, belonging to a different group of Pupæ. The aperture is imperfectly known and its generic relations therefore doubtful.

PUPA PRIMAEVA G. F. Matthew, Proc. and Trans. Roy. Soc. Canada for 1894, XII, 1895, section iv, p. 98, pl. 1, f. 10*a*, *b*. Pennsylvanian: Little River Group: Fern Ledges, Lancaster, St. John Co., N. B., in Plant Bed No. 2.

As the aperture is unknown, this species cannot be definitely classified. With sculpture like *Dendropupa,* it has fewer and longer whorls. It occurred in the same bed in which *Strophites grandæva* was found.

STROPHITES GRANDÆVA Dawson [Pl. 32, fig. 16], Amer. Journ. Sci. (3), XX, 1880, p. 413, f. 15. Pennsylvanian: plant beds of St. John, New Brunswick.

This genus and species was proposed for a fossil about 8 mm. long, sharply ribbed axially, and thought to be thin-shelled, "cylindrical with obtuse apex; whorls four or more." The affinities of this form remain quite uncertain, the comparison with *Strophia* (*Cerion*) being fanciful.

ADDENDA

ORCULA DOLIOLUM VOHLANDI, new name for *Orcula doliolum* var. *tumida* Vohland, this Vol., p. 22 (not *tumida* Hazay, p. 8, or *tumida* Nevill, p. 145).

ORCULA KASNAKOVI. *Pupa kasnakovi* Rosen, Mittheilungen Kaukasischen Museums, VI, 1914, is a Transcaucasian species of which I have been unable to obtain the description.

LAURIA CYLINDRACEA (Da C.) Vol. XXVII, p. 47.

Notes on the nomenclature, distribution etc. by M. Margier are quoted in Bull. Soc. Sci. Hist. et Nat. de la Corse, XXII, 1903, p. 276.

Page 53, third line. For initial *A*, substitute *L*. Add the reference: *Pupa cylindracea* var. *misella* Paulucci, Bull. Soc. Malac. Ital. VIII, 1882, p. 279, pl. 8, fig. 2.

Mut. *rufilabris* Jackson. "Similar in all respects to the type, except the lip, which is reddish. It is not var. *semproni* (Charp.), as this is smaller and toothless. I have found this form accompanying the type in a great many places up and down the country. It is very common at Grange, Silverdale etc., Serpentine Walks" ([*Jaminia cylindracea*] var. *rufilabris* J. W. Jackson, Mollusca of Kendal, Westmoreland, Journ. of Conch. XII, 1909, p. 313).

Vol. XXVII, p. 54, 5th line from bottom: for "Syria" read Syra.

AGARDHIA TRUNCATELLA BIARMATA (Bttg.), this volume, p. 164.

The form described and figured by Sturany from a cave near Zavala, Herzegovina (the description and figures reproduced in this volume, p. 165, pl. 19, figs. 11, 12), has been named *Coryna biarmata spelaea* Kobelt, Iconographie Land- und-Süsswasser-Mollusken, n. F., XII, 1906, p. 23, pl. 311, fig. 1979. The size of *spelaea* is length 4, diam. 1.7 mm.

Just how *spelaea* differs from typical *biarmata* has not been made clear. Boettger's type of the latter has not been figured. The figures published by Sturany (pl. 19, figs. 11, 12), Sturany and Wagner (figs. 9, 10) and myself (figs. 13, 14) do not appear to differ materially.

CHONDRINA AVENACEA Brug., var. *latilabris* Stossich. Lip broadened, rose-colored. Rare at San Daniele di Gorgna, Venetian Alps (*Torquilla avenacea* Brug. var. *latilabris* STOSSICH, Boll. Soc. Adriatica di Scienze Naturali in Trieste, XVI, 1895, p. 204). A var. *elongata* is said to be described in Vol. XIX of the same bulletin, not accessible to me at present.

CHONDRINA PSAROLENA var. *rutuba* Caziot. Eight whorls of the spire not very convex; suture quite deep; increase of the whorls progressive; aperture oblique (150°). Height 8½ mm., of aperture 2¾, height of last whorl 4 mm. Dep. Alpes-Maritimes; named for the "torrent la Roya." ([*Pupa psarolena*] var. *rutuba* Caziot, Etude les mollusques terrestres et fluviatiles de la Principauté de Monaco et du Dép des Alpes maritimes, 1910, p. 315, pl. 9, figs. 21, 22).

PAGODULINA SUBDOLA GRACILIOR, new name for *Pupa pagodula* forma *gracilis* Bttg., West. (this vol. pp. 177, 178). The name *gracilis* had been used many times in *Pupa* before it was applied to this form.

TRUNCATELLINA JANINENSIS, new name for *Pupa minutissima* var. *obscura* Mouss. (Vol. XXVI, p. 67), not *Pupa obscura* Mühlf.

Genus (?) PARACORYNA Flach.

The group *Paracoryna* Flach, on page 132 might better be considered distinct from *Agardhia*. In subordinating it to the latter, it was not noticed that *Paracoryna* is earlier by twenty-one years, *Agardhia* dating from September, 1911.

EXPLANATION OF PLATES

Except where otherwise stated, the specimens figured are in the Museum of the Academy of Natural Sciences and were drawn by Helen Winchester. Figures borrowed from other works have been copied photographically.

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[1] The name *plagiostoma* is preoccupied, but probably Nevill's form is not a valid race and will not require a new name.

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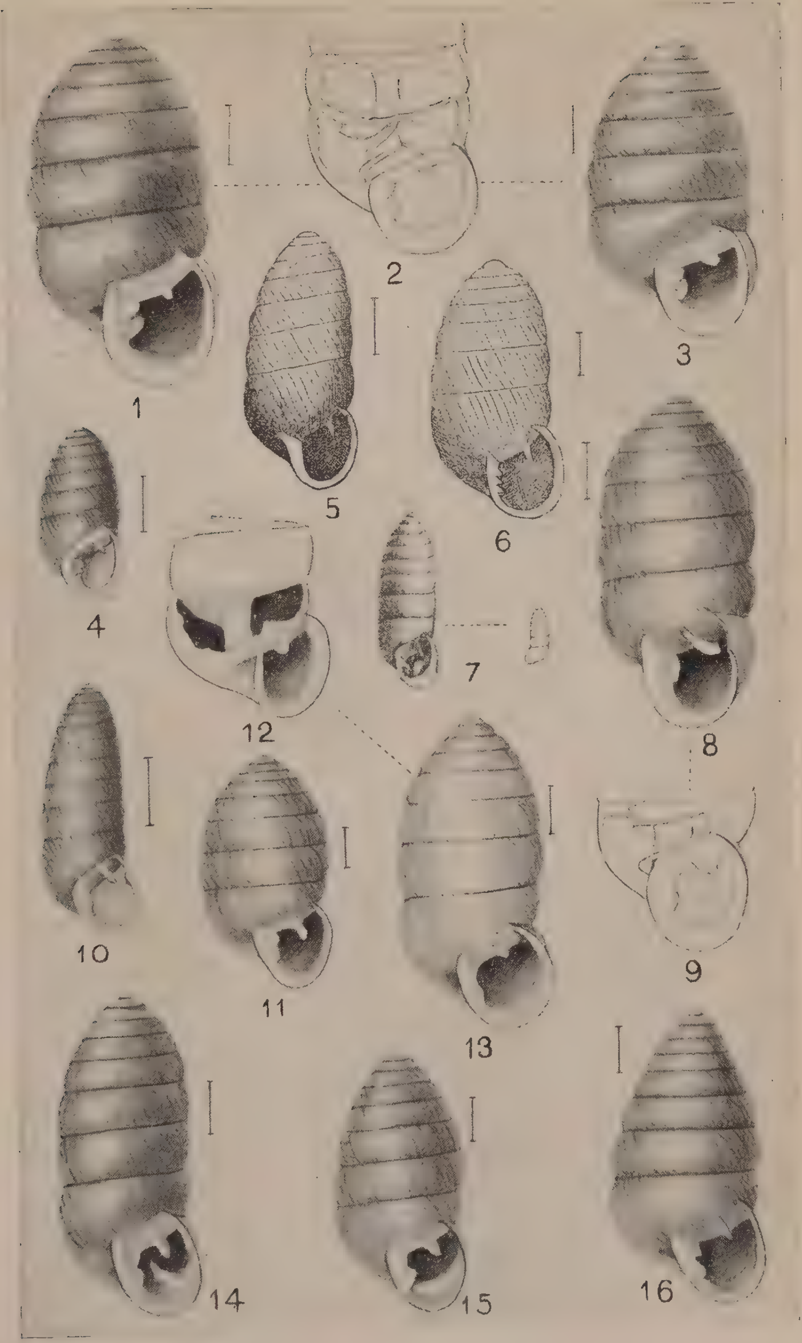
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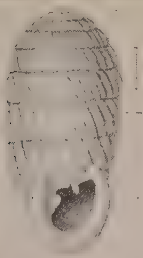
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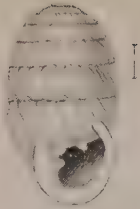
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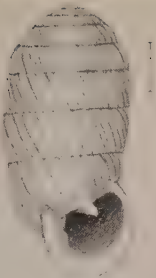
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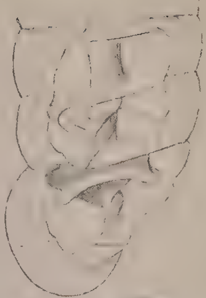
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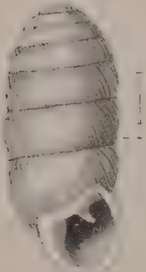
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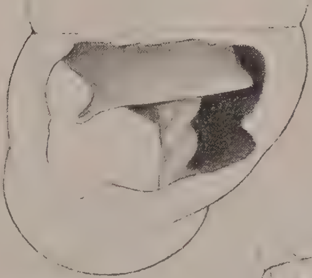
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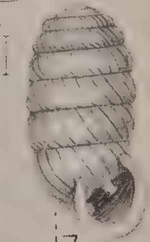
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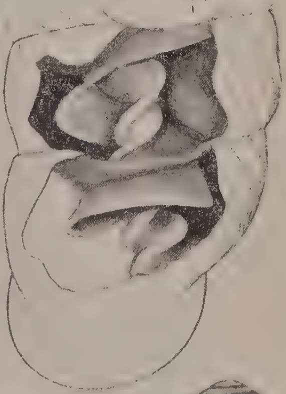
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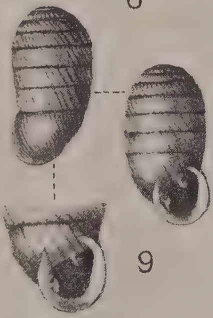
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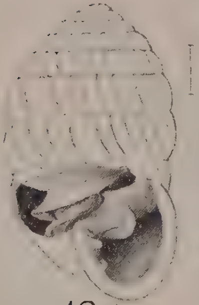
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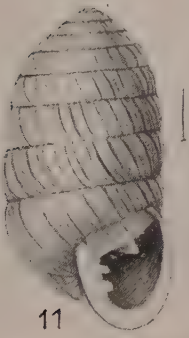
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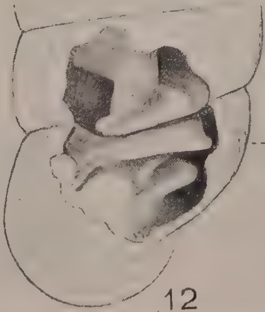
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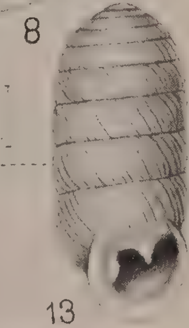
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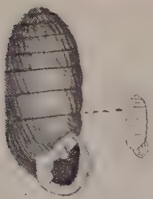
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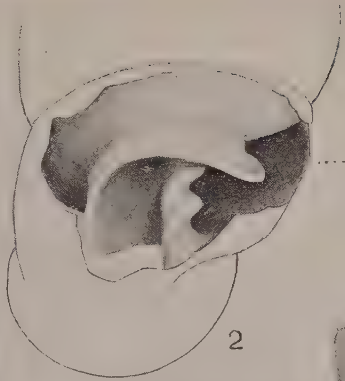
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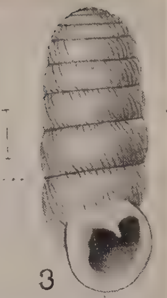
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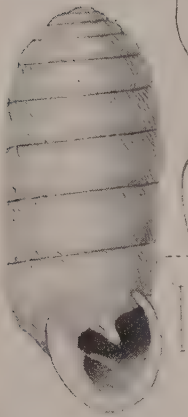
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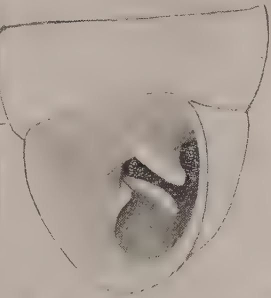
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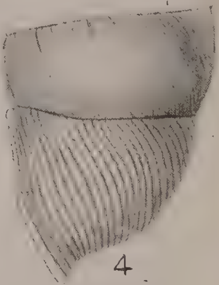
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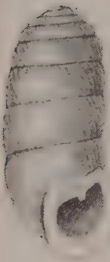
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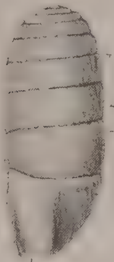
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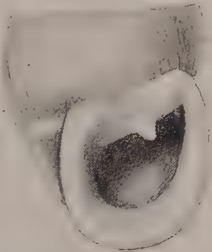
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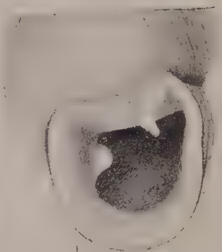
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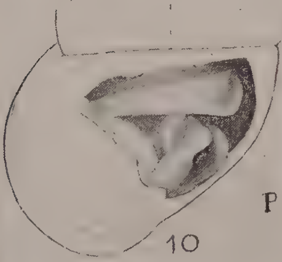

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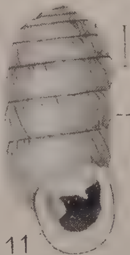
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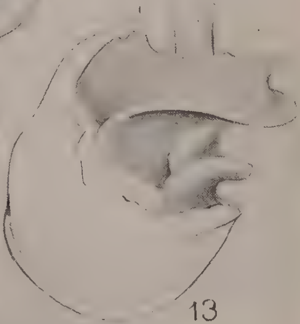
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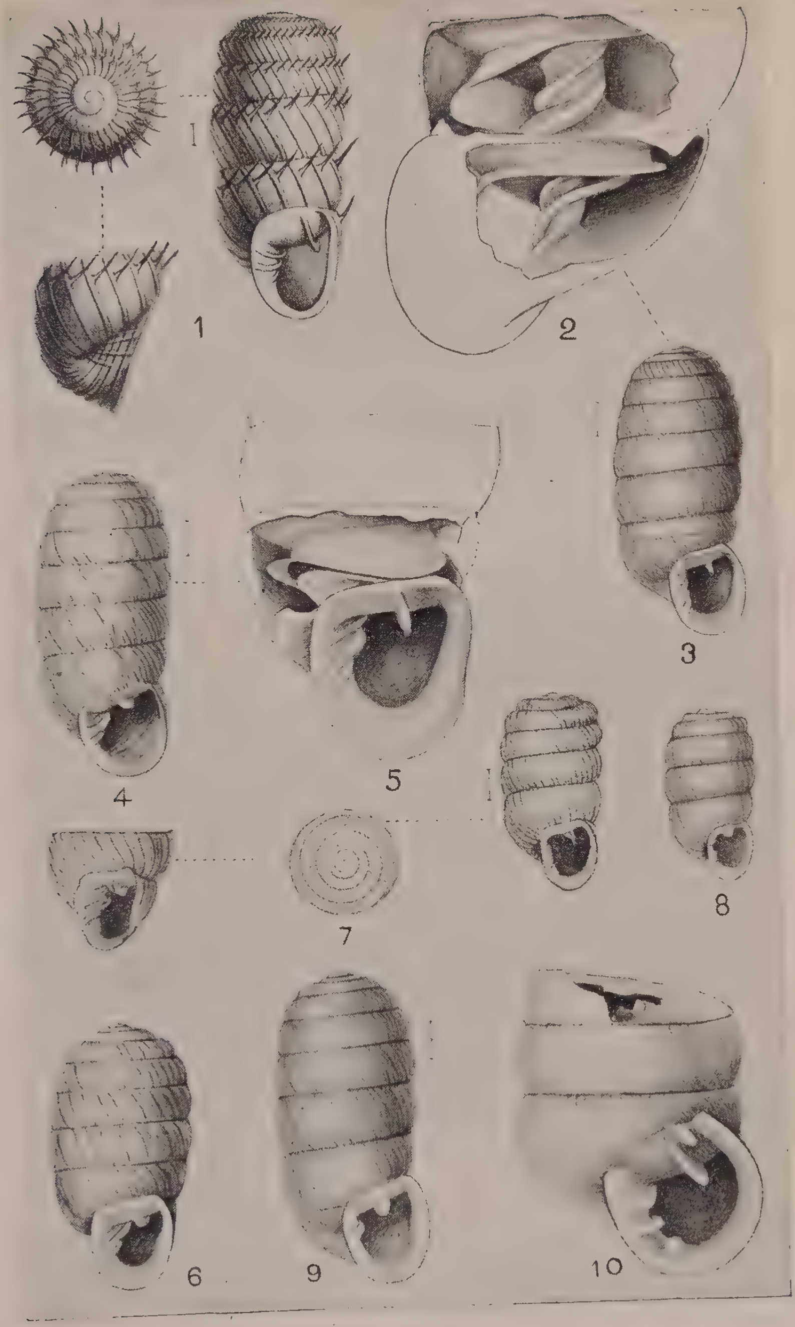
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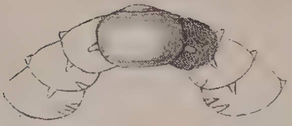
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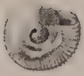
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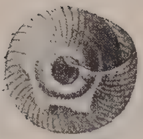
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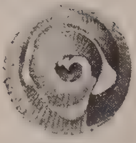
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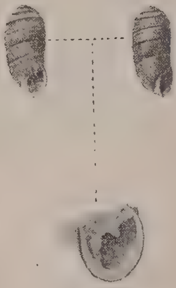
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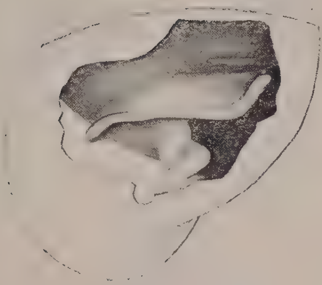
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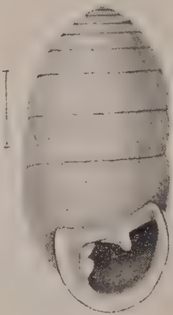
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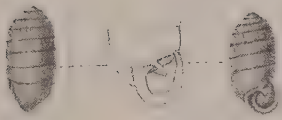
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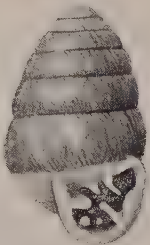
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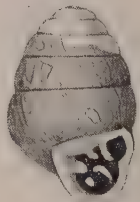
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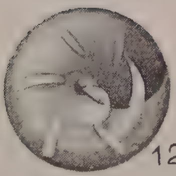
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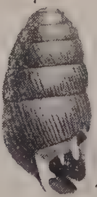
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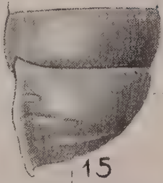
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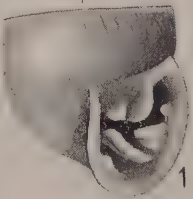
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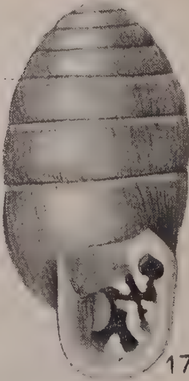
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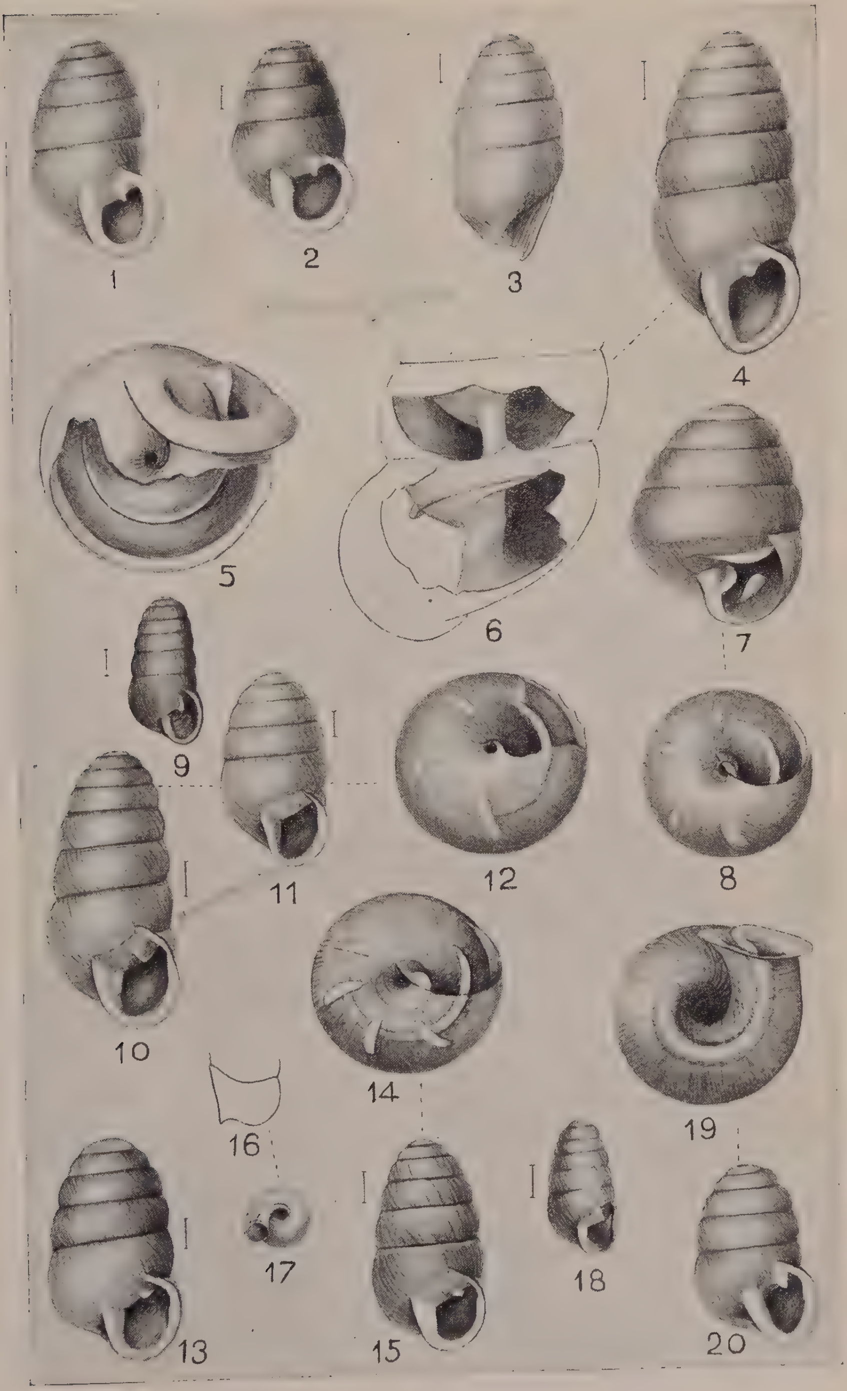
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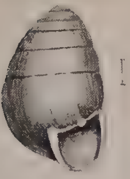
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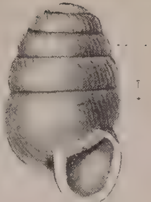
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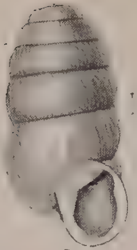
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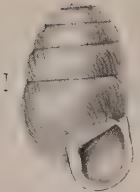
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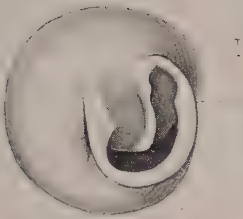
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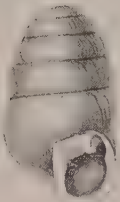
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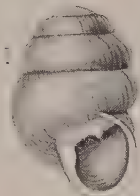
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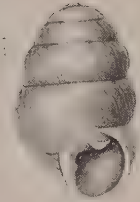
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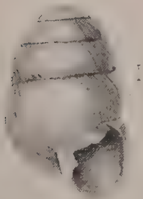
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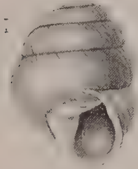
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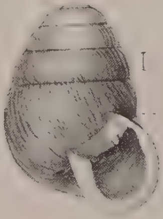
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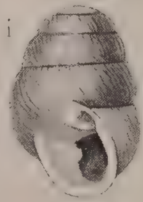
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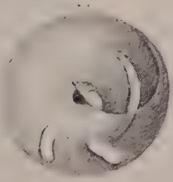
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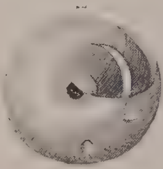
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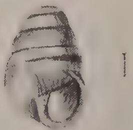
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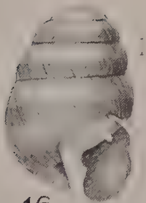
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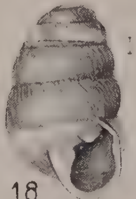
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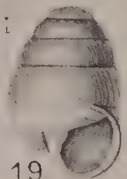
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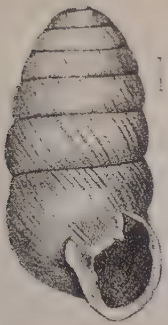
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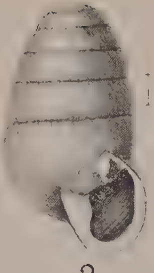
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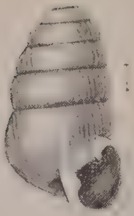
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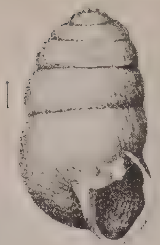
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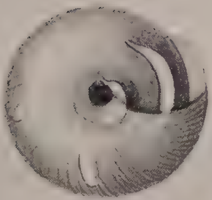
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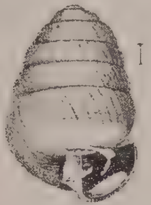
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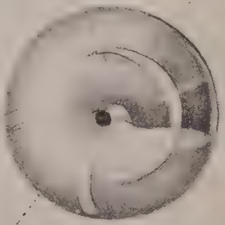
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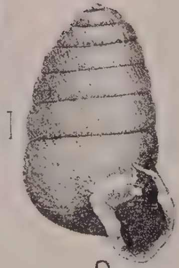
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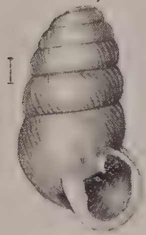
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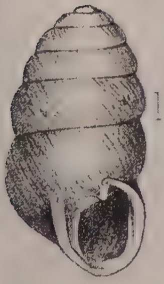
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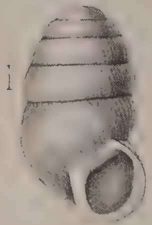
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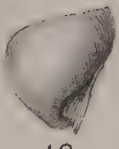
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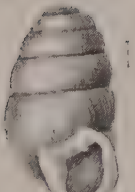
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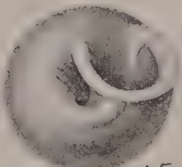
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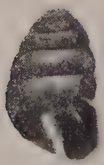
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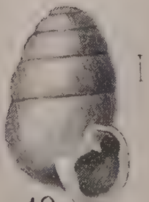
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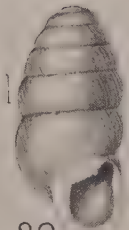
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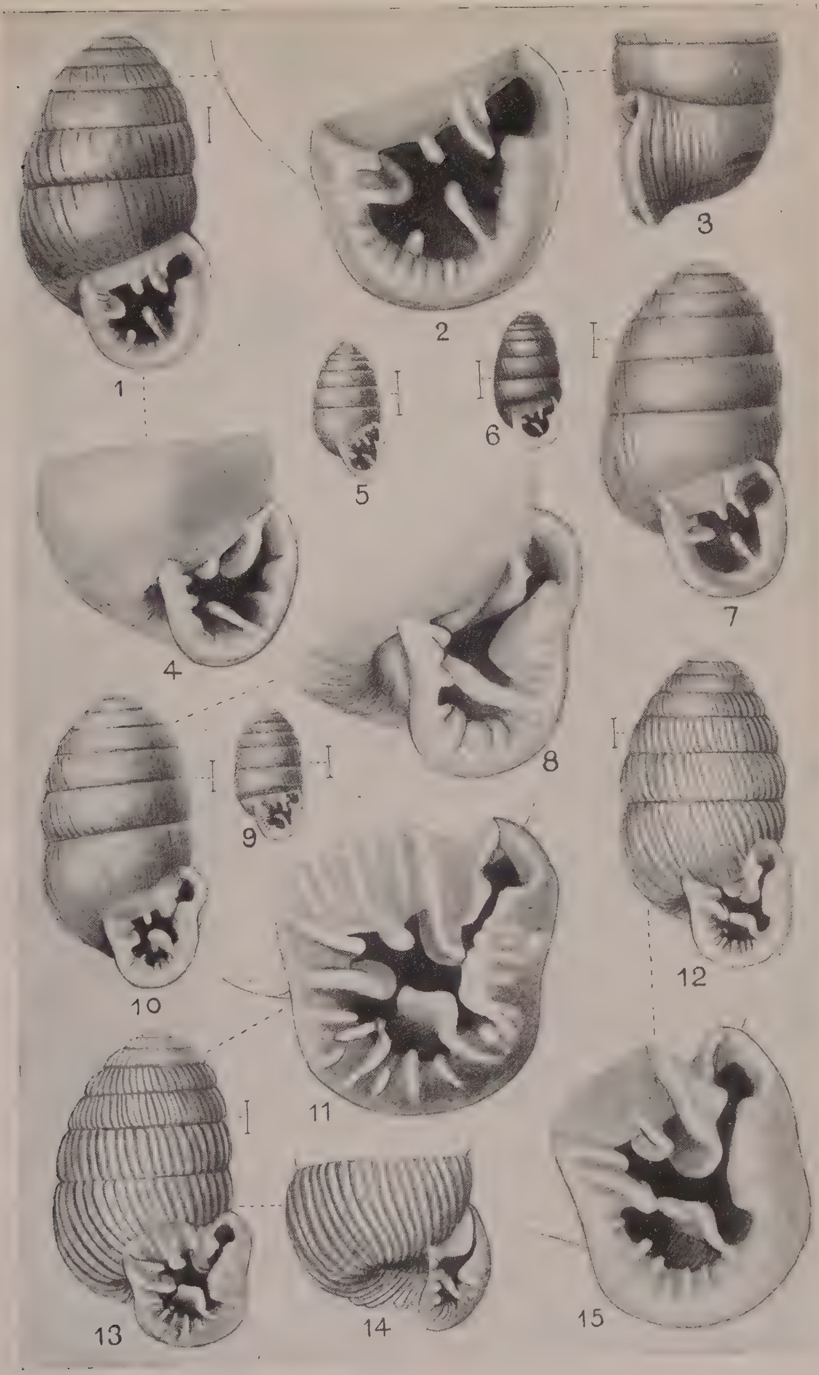
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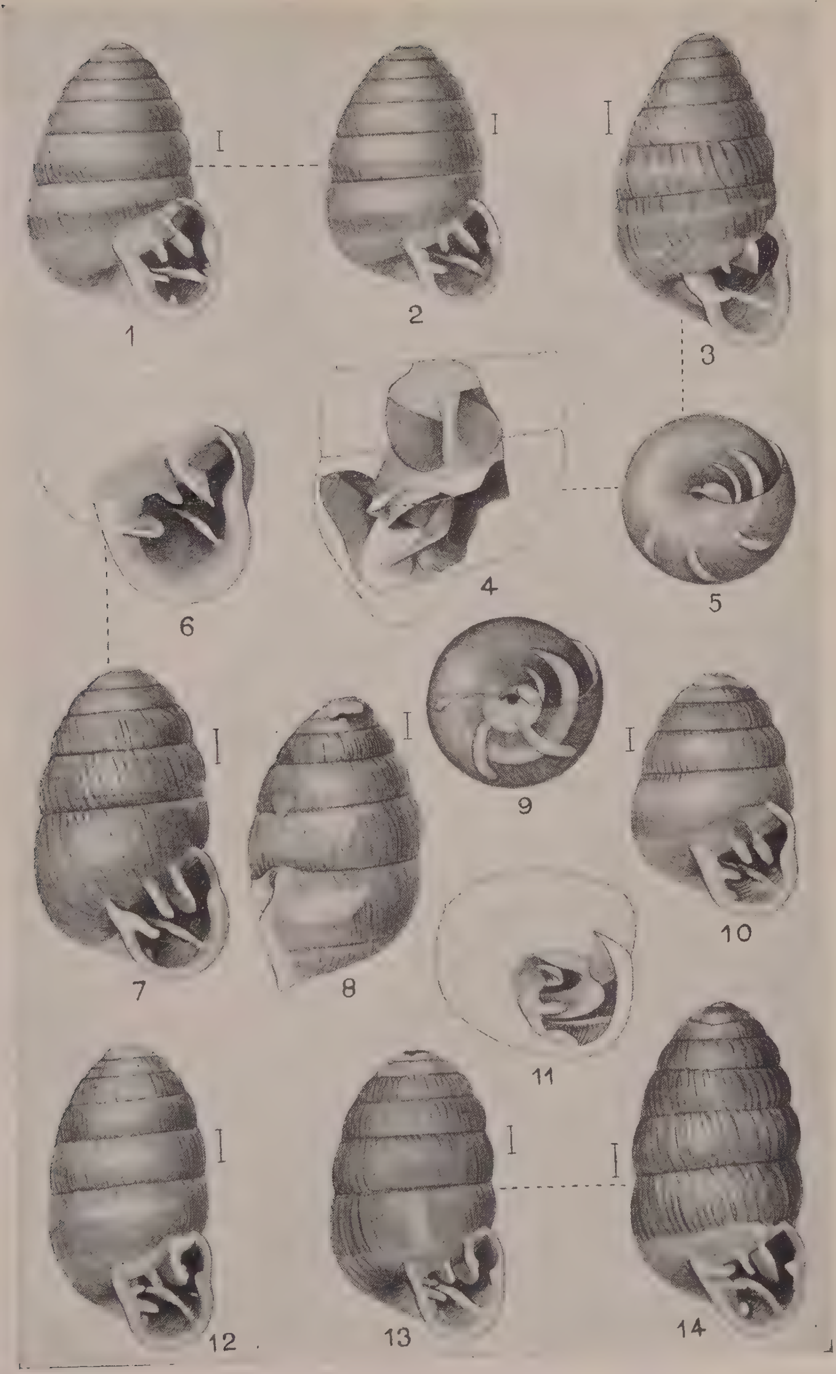
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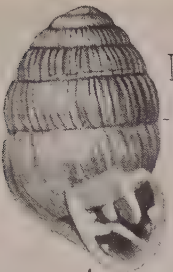
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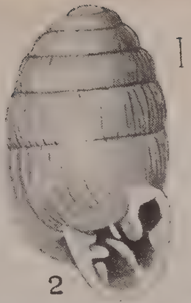
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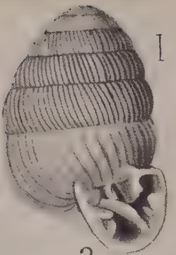
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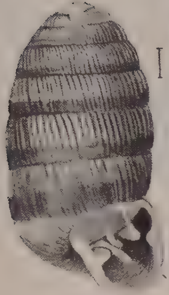
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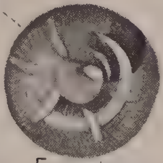
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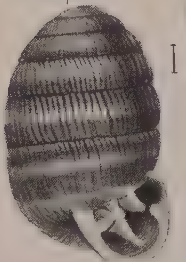
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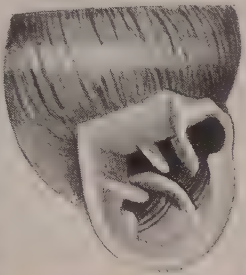
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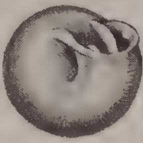
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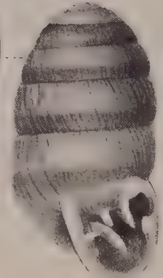
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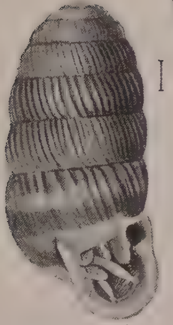
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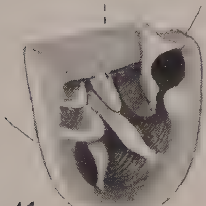
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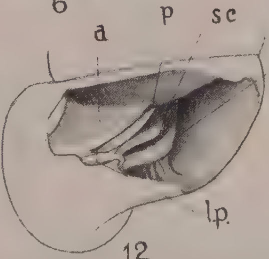

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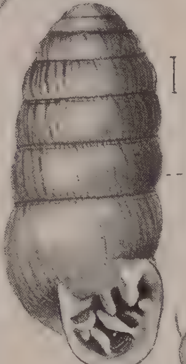
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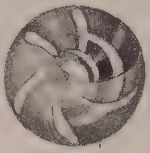
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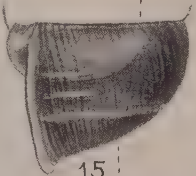
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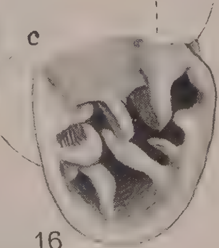

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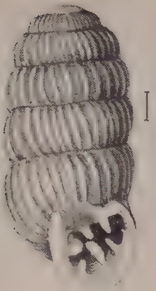
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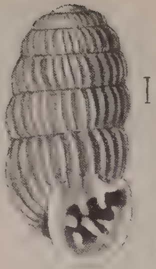
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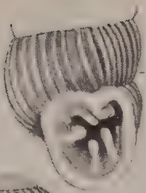
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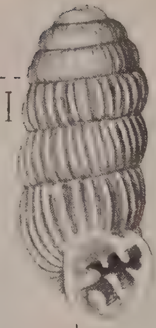
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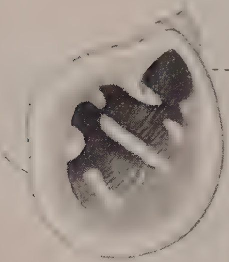
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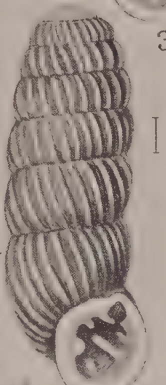
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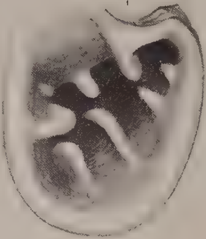
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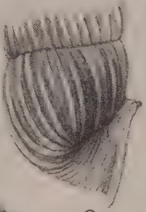
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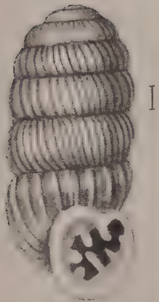
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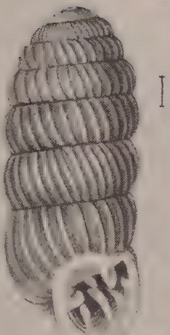
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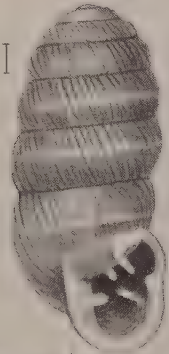
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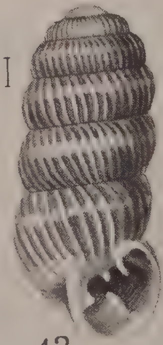
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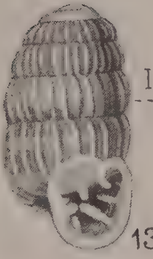
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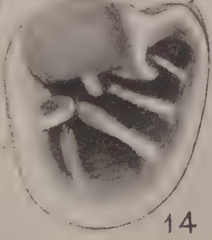
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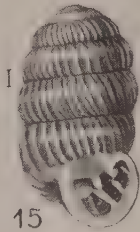
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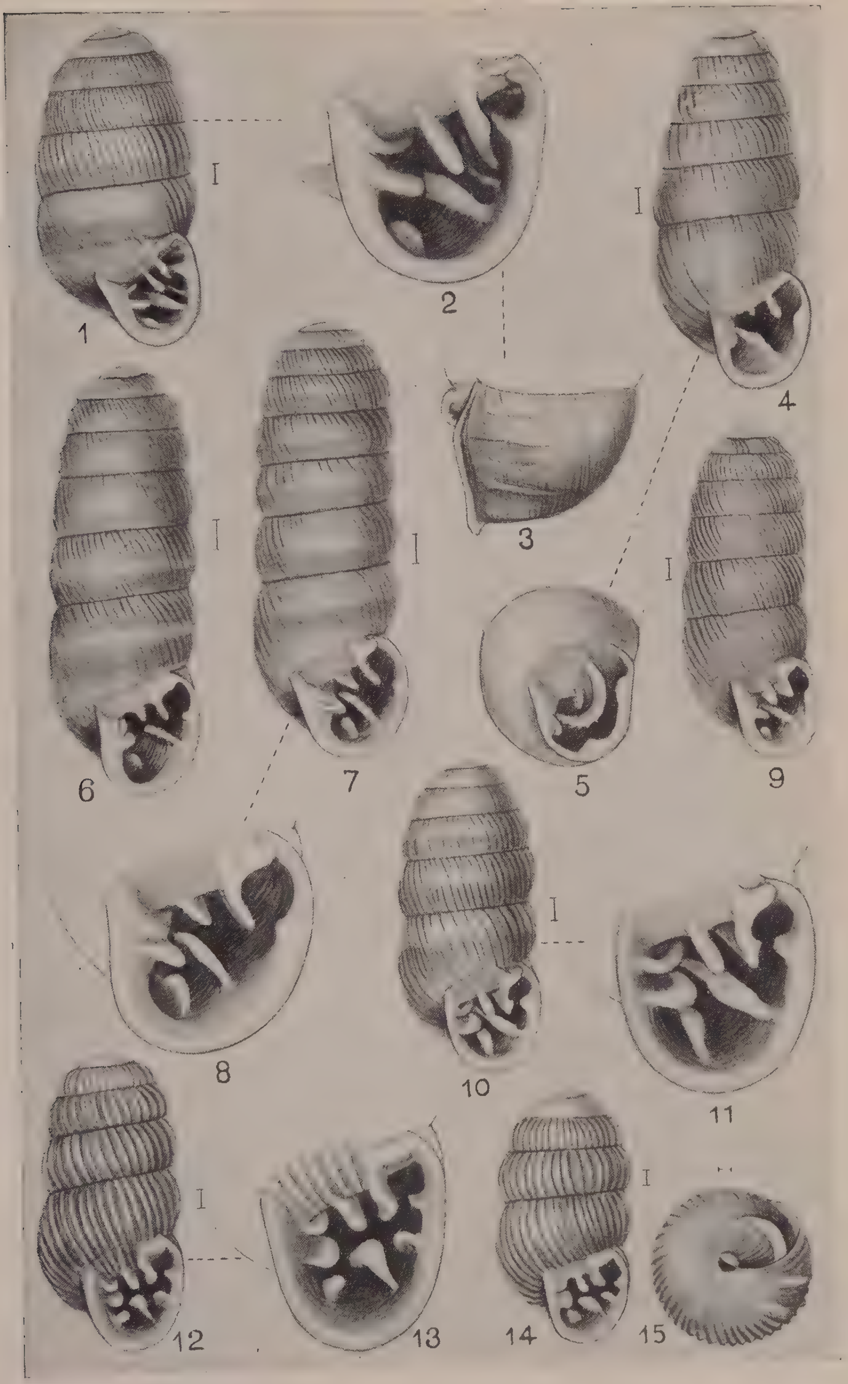
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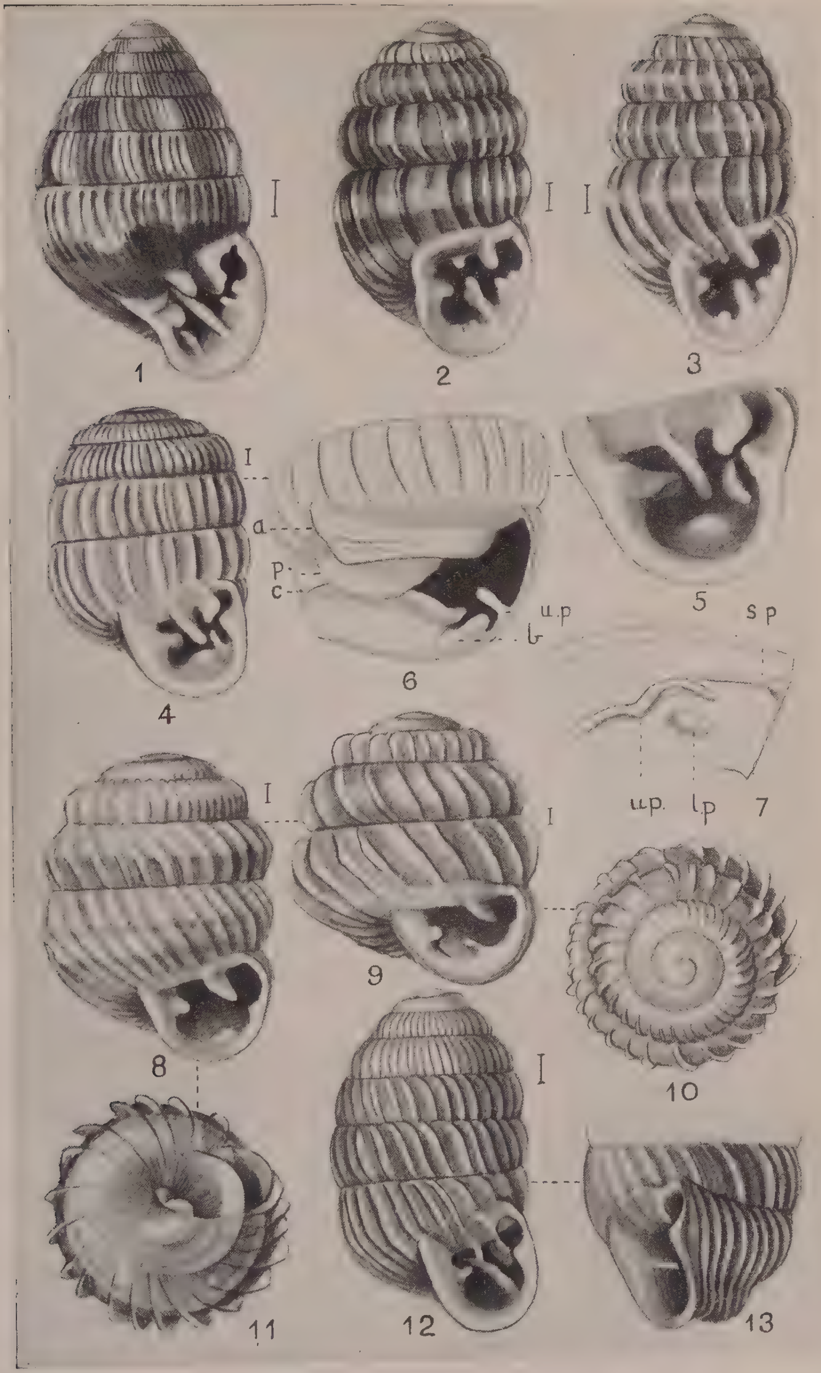
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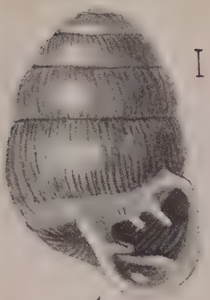
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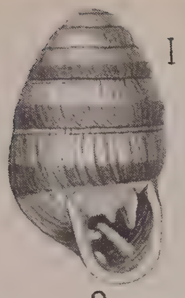
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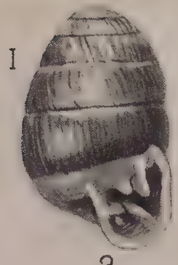
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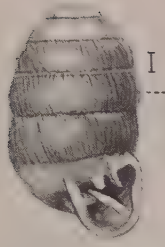
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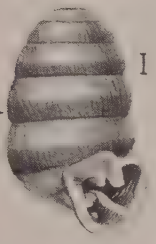
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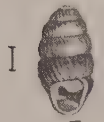
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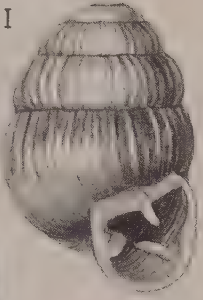
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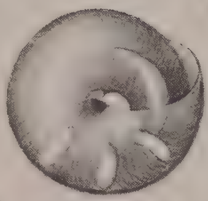
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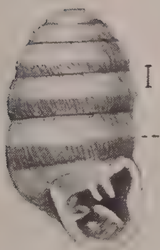
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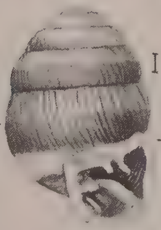
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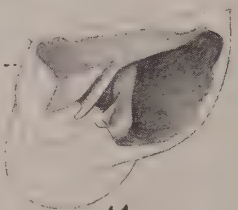
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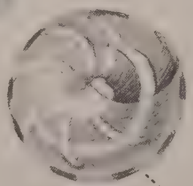
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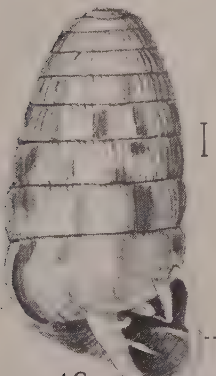
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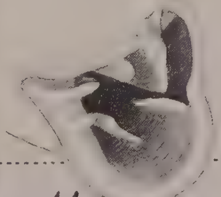
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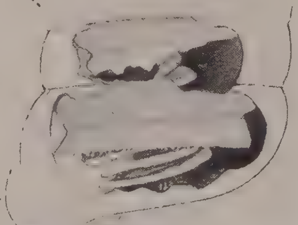
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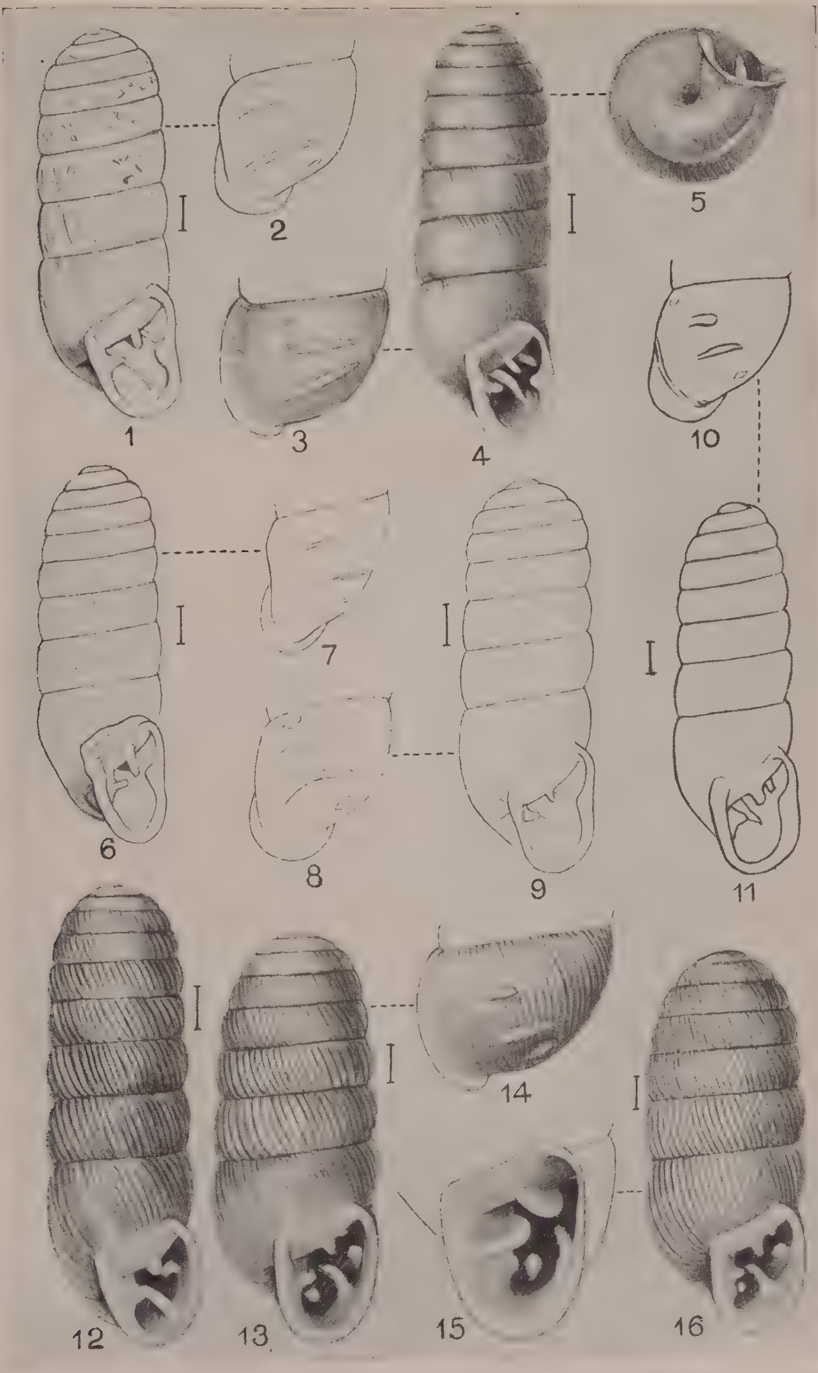
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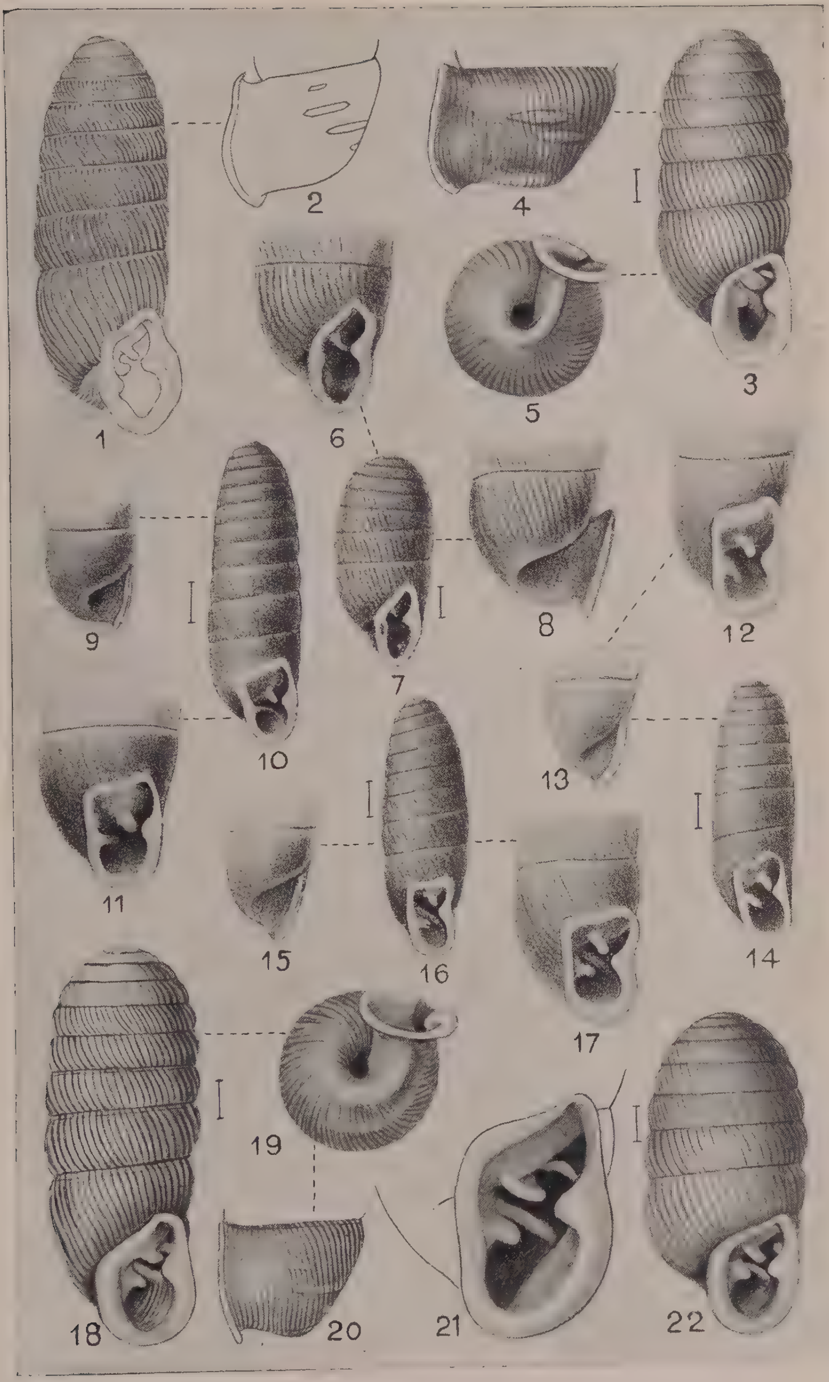
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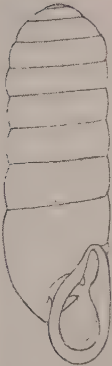
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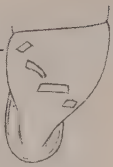
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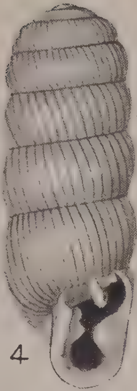
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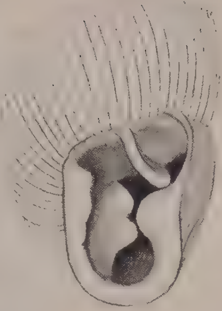
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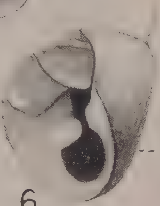
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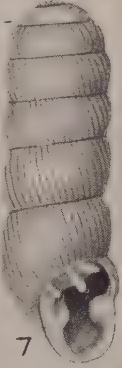
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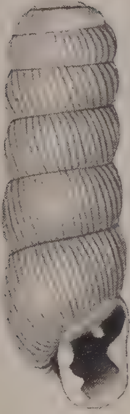
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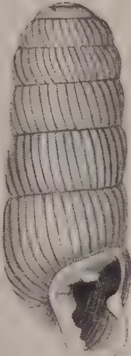
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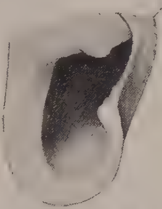
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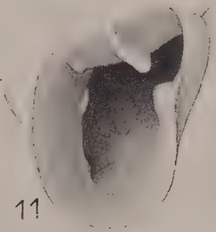
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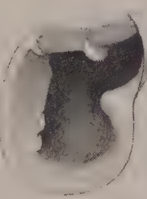
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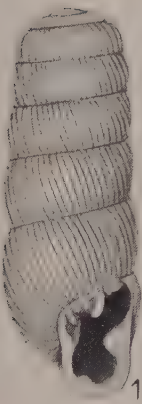
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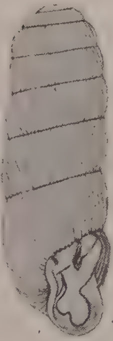
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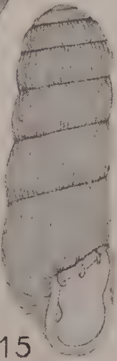
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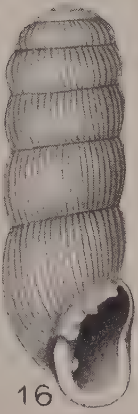
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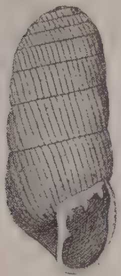

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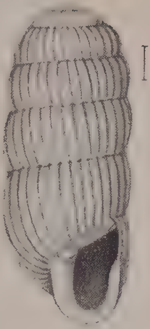

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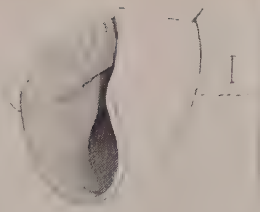

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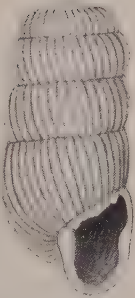

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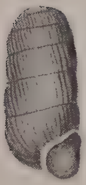

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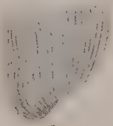

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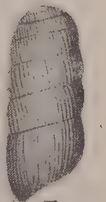

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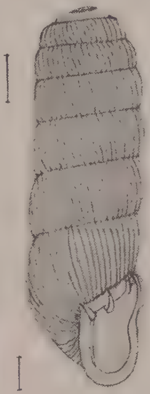

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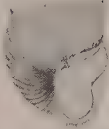

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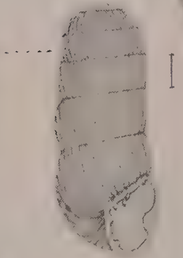

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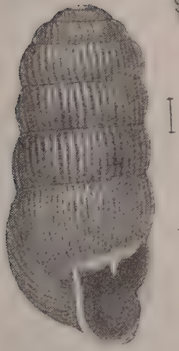

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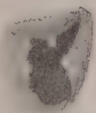

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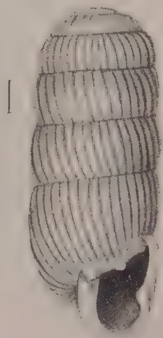

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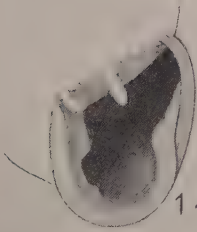

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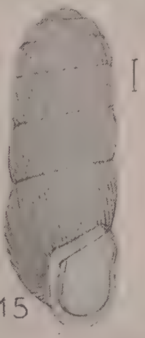

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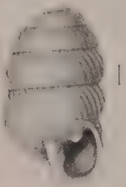

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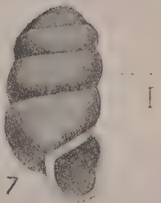

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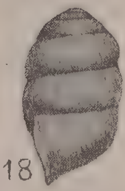

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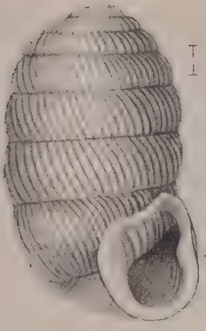
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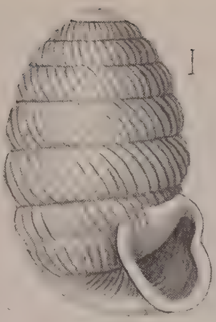
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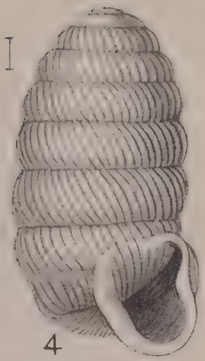
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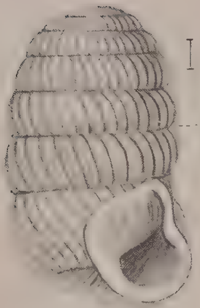
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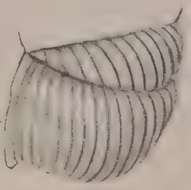
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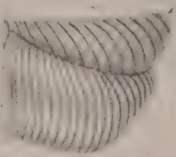
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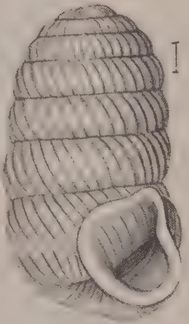
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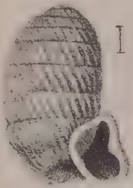
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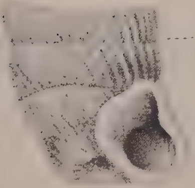
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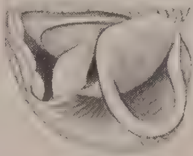
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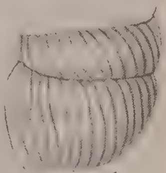
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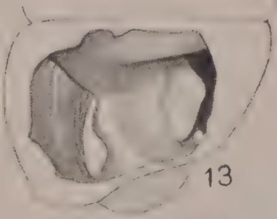
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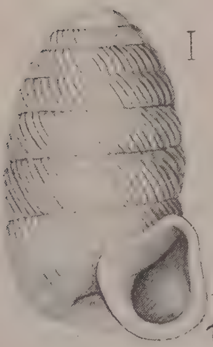
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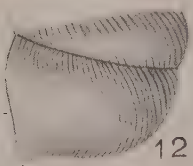
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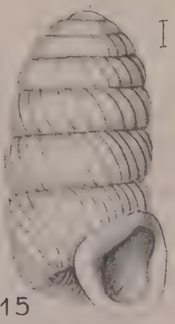
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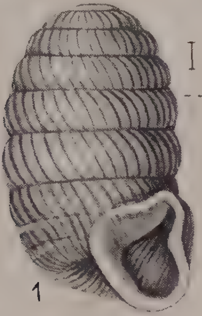
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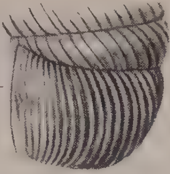
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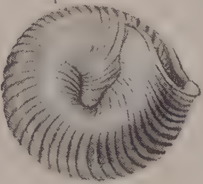
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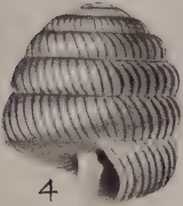
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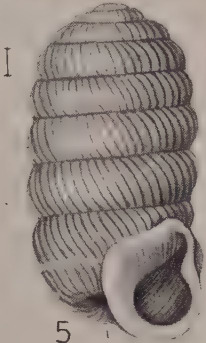
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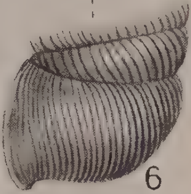
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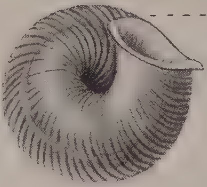
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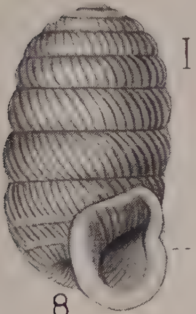
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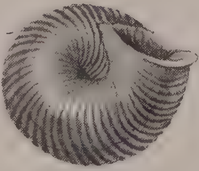
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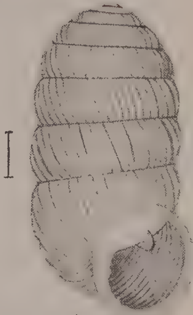
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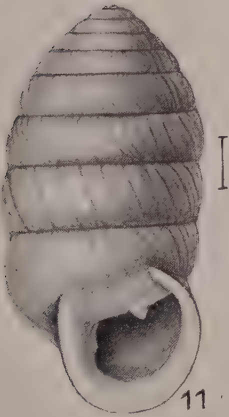
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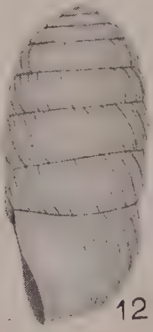
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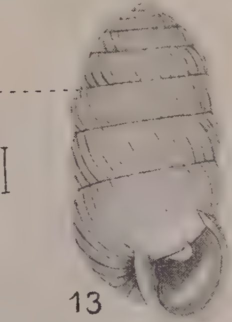
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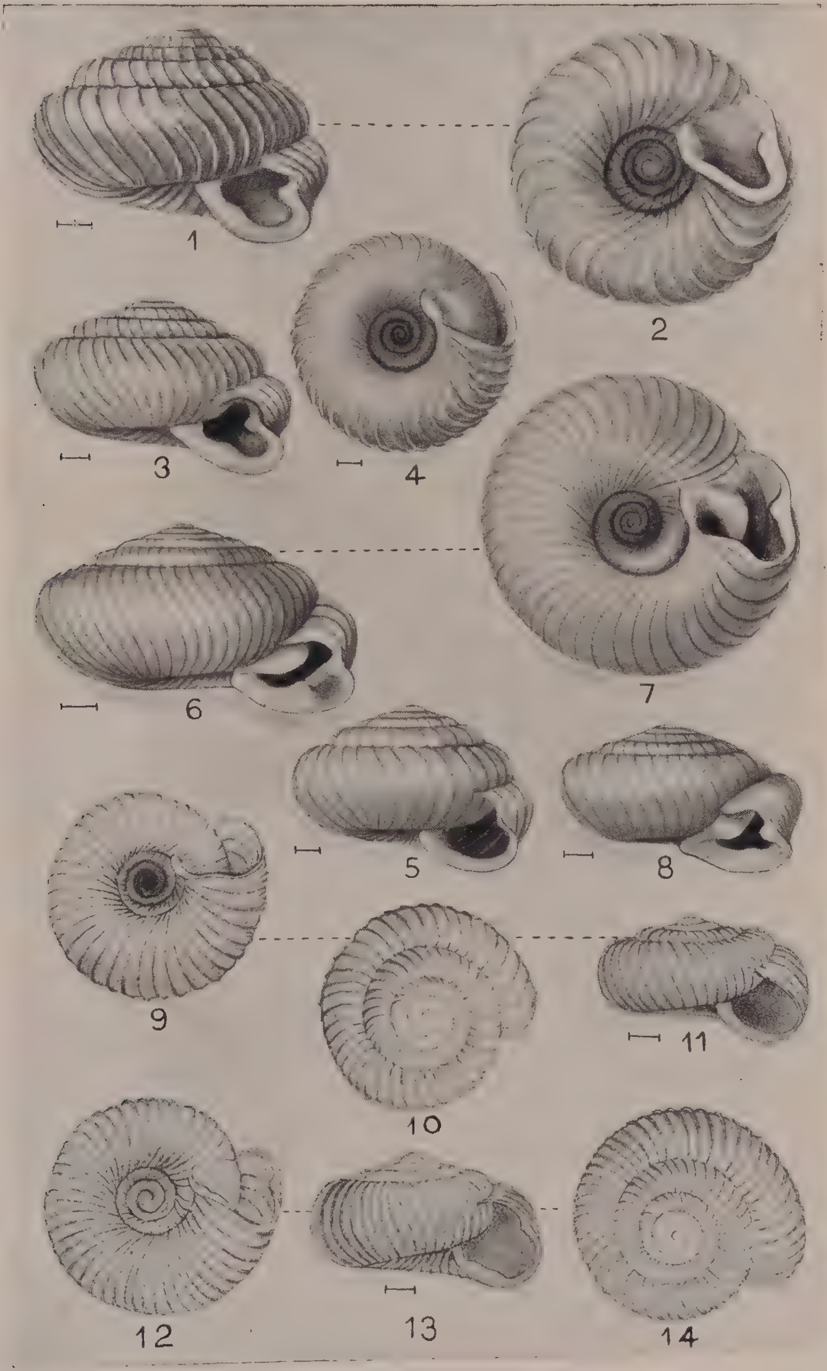
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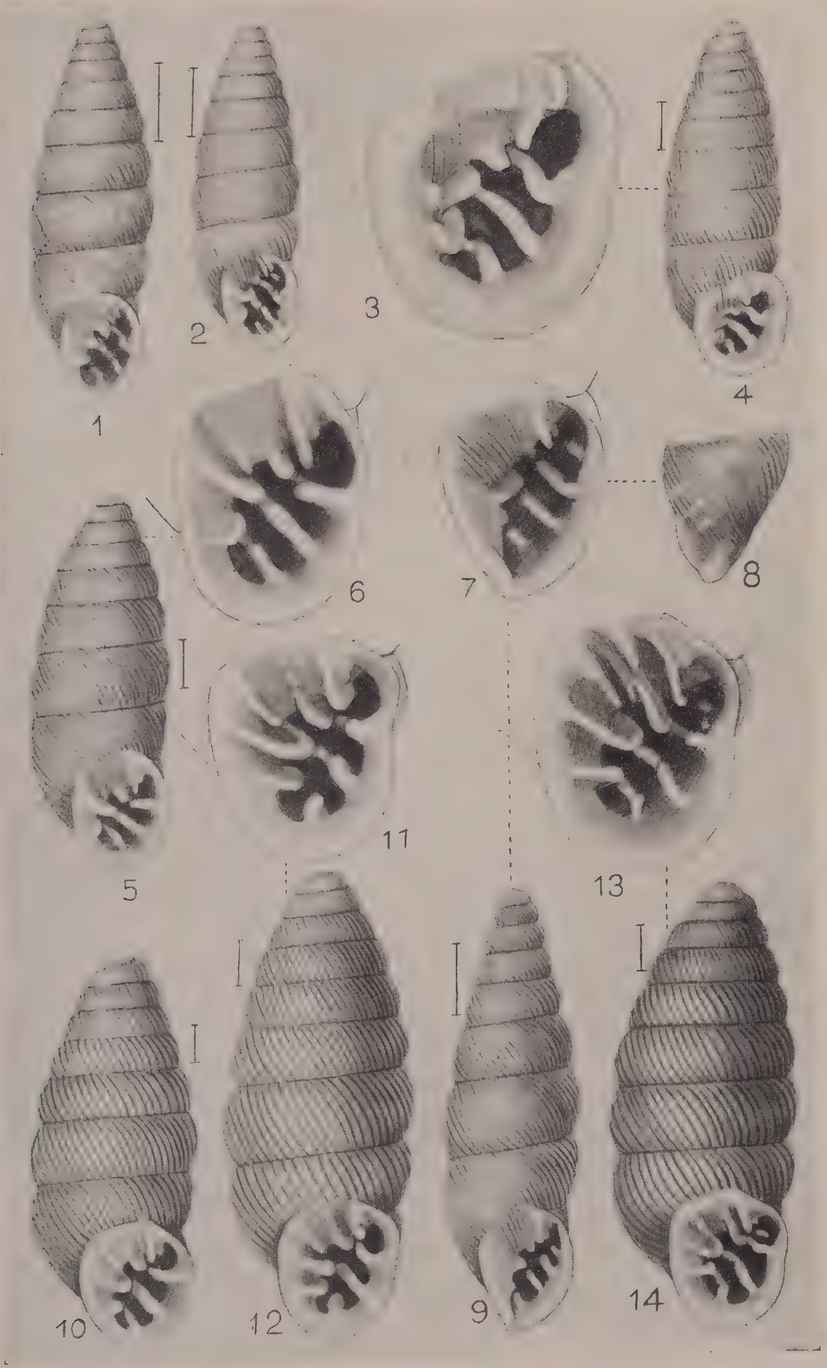
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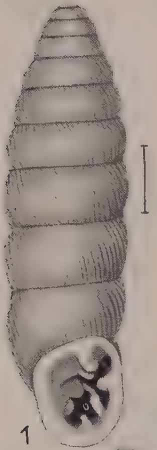
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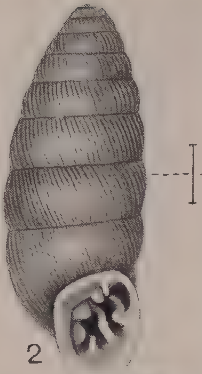
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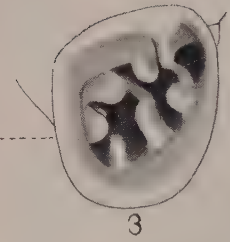
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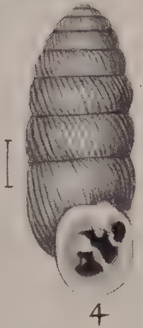
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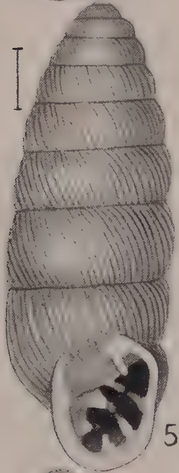
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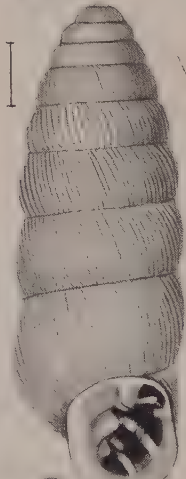
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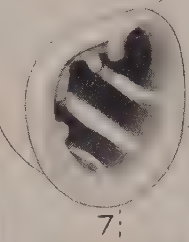
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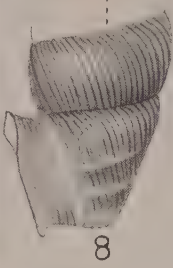
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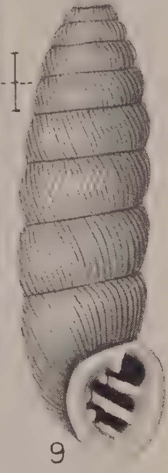
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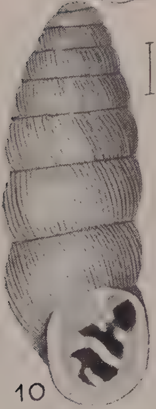
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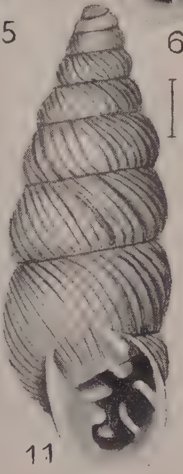
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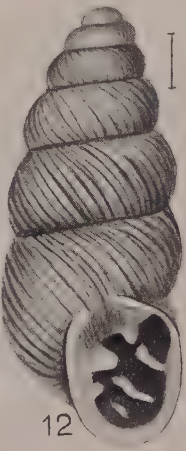
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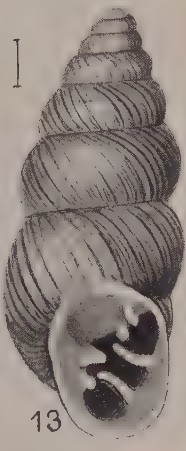
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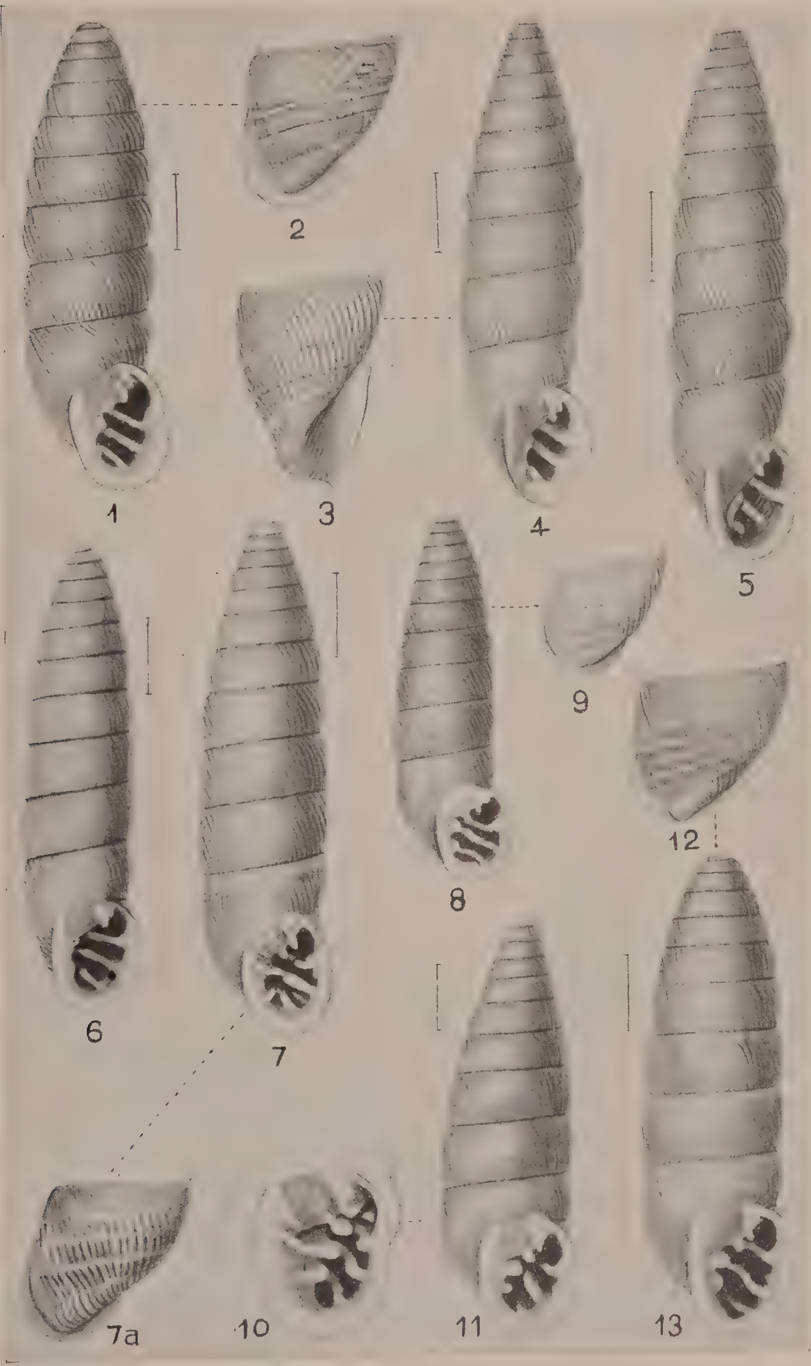
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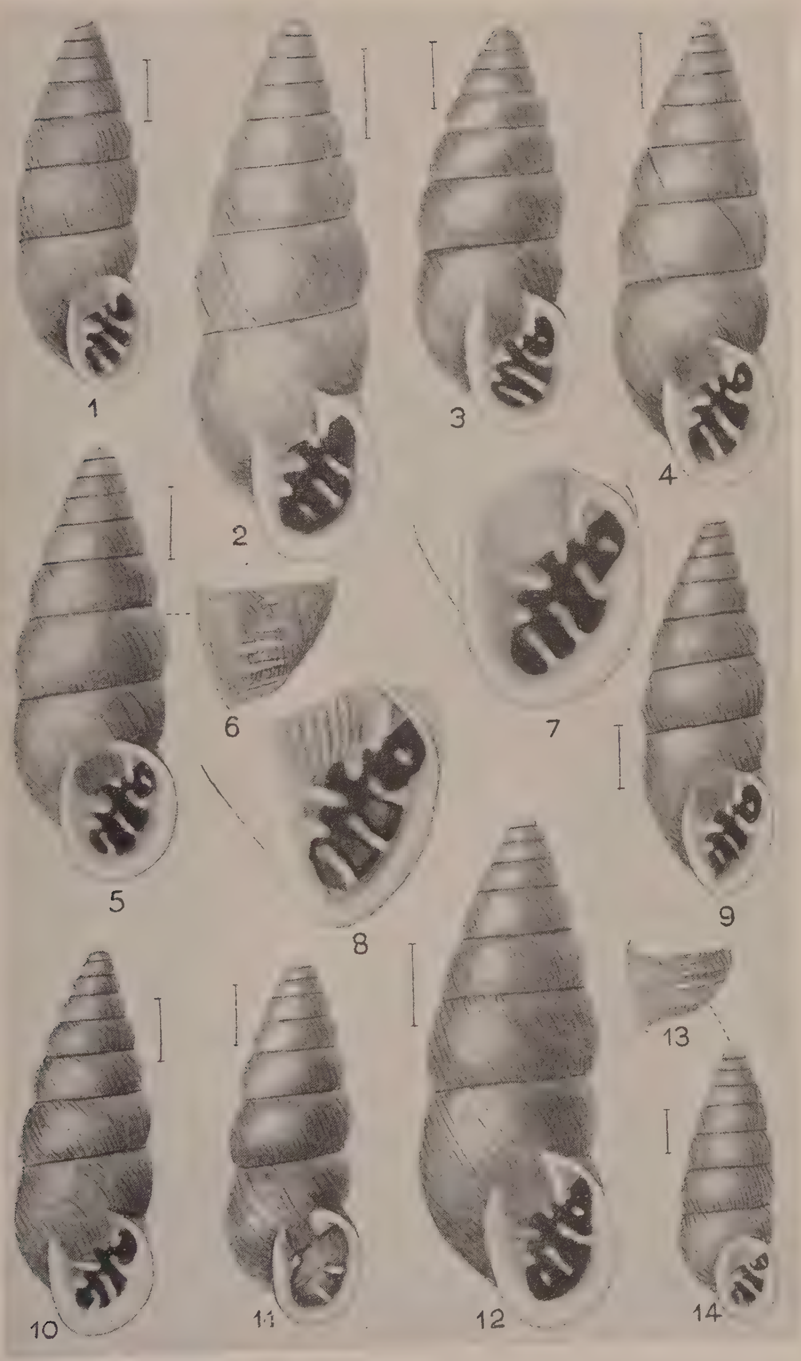
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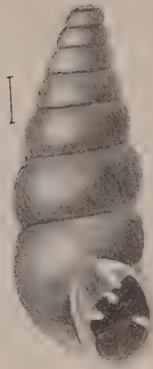
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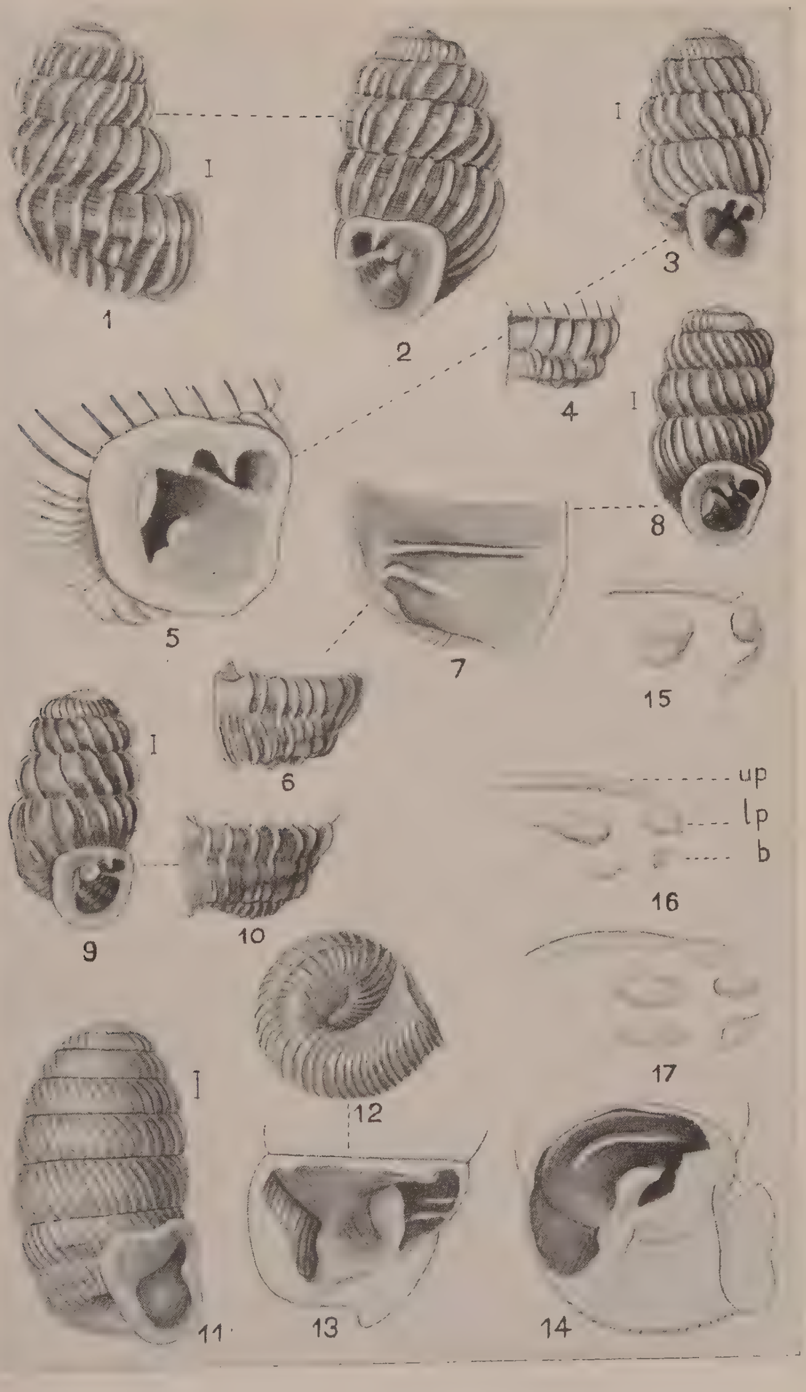
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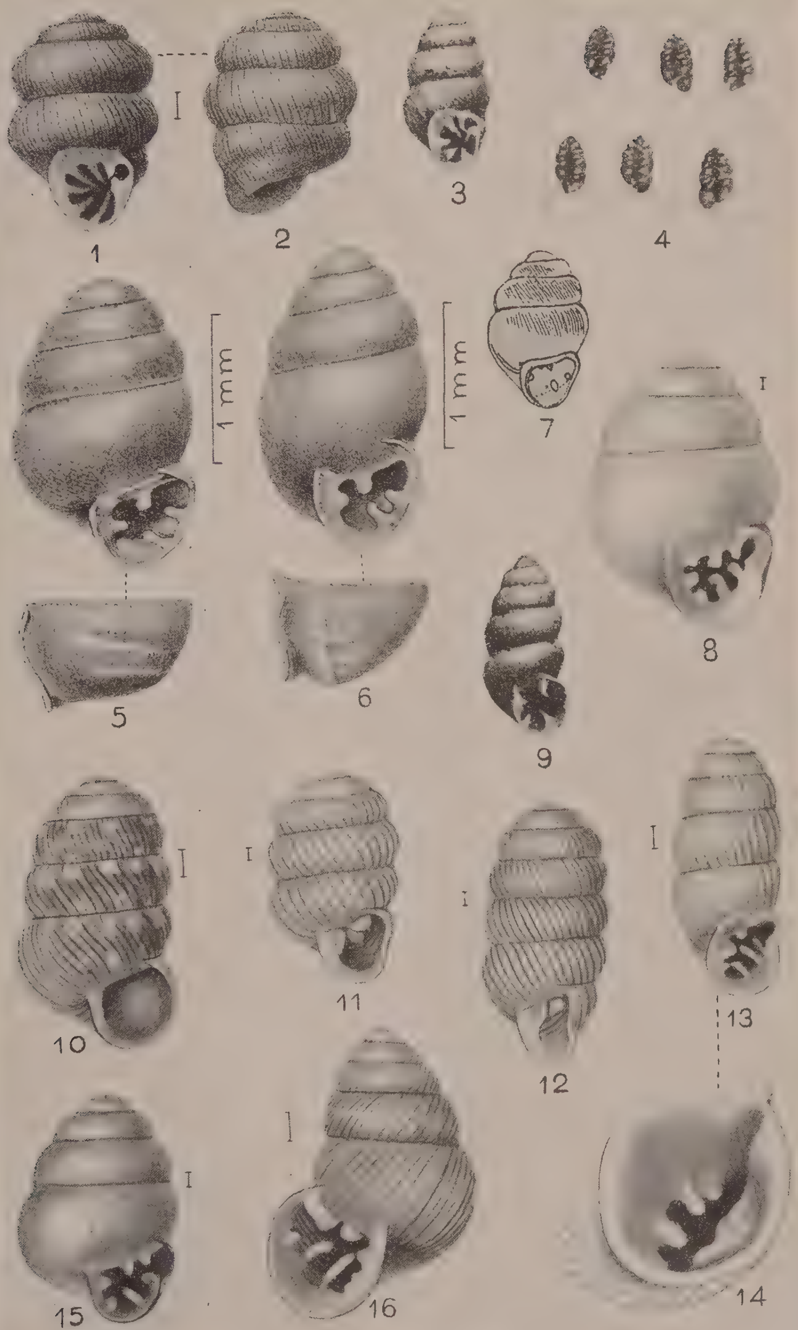
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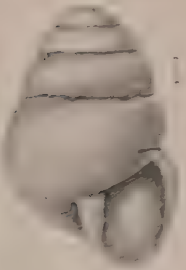
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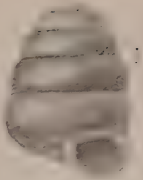
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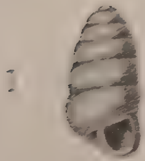
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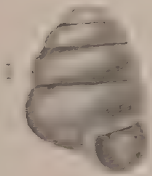
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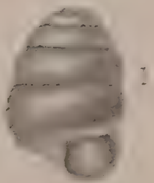
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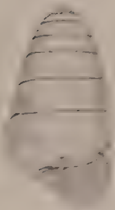
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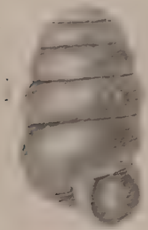
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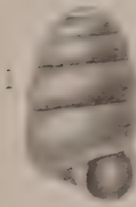
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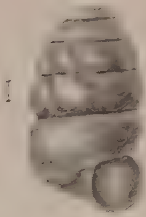
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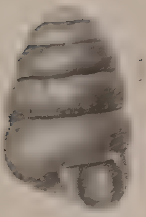
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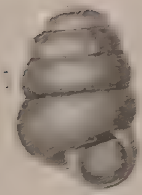
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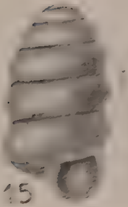
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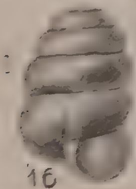
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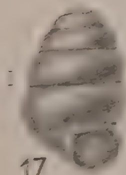
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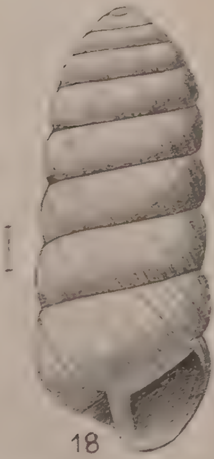
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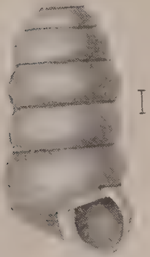
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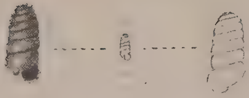
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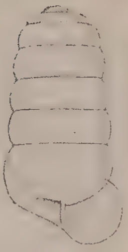
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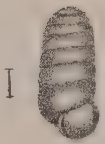
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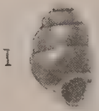
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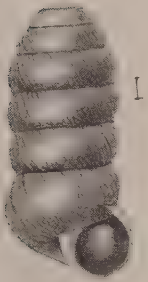
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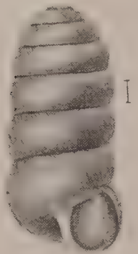
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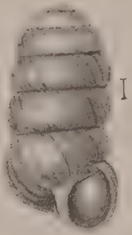
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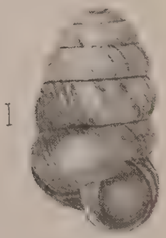
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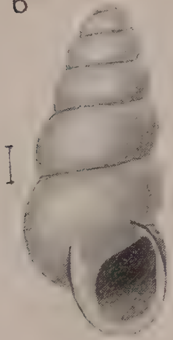
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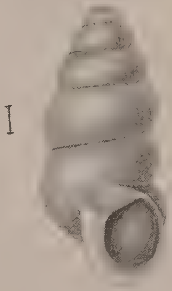
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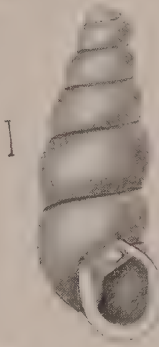
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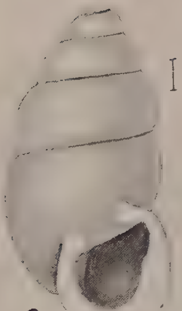
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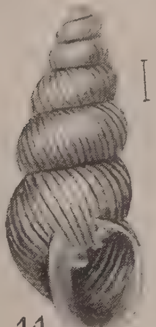
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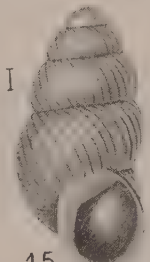
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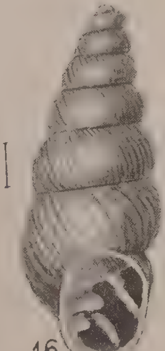
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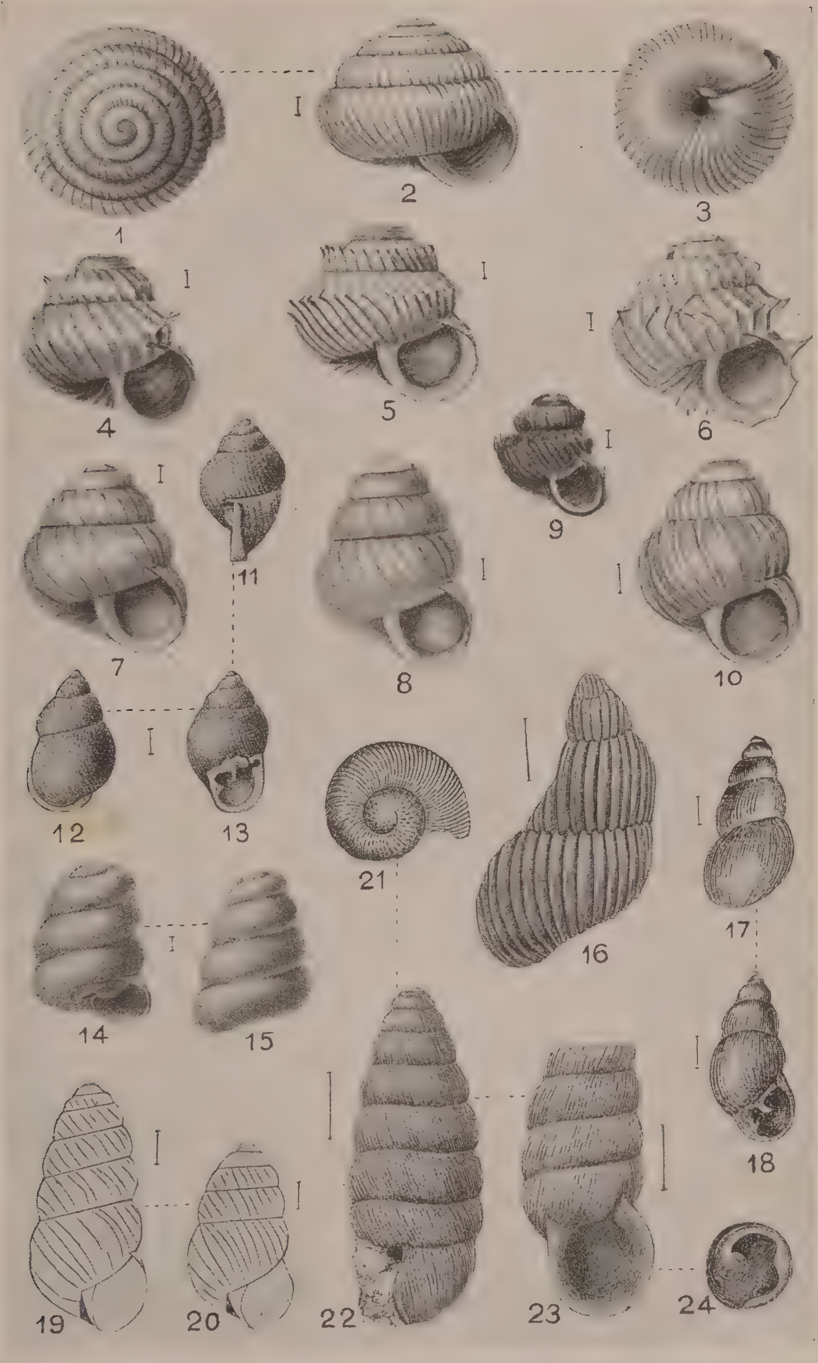
PUPILLIDÆ PLATE 32



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